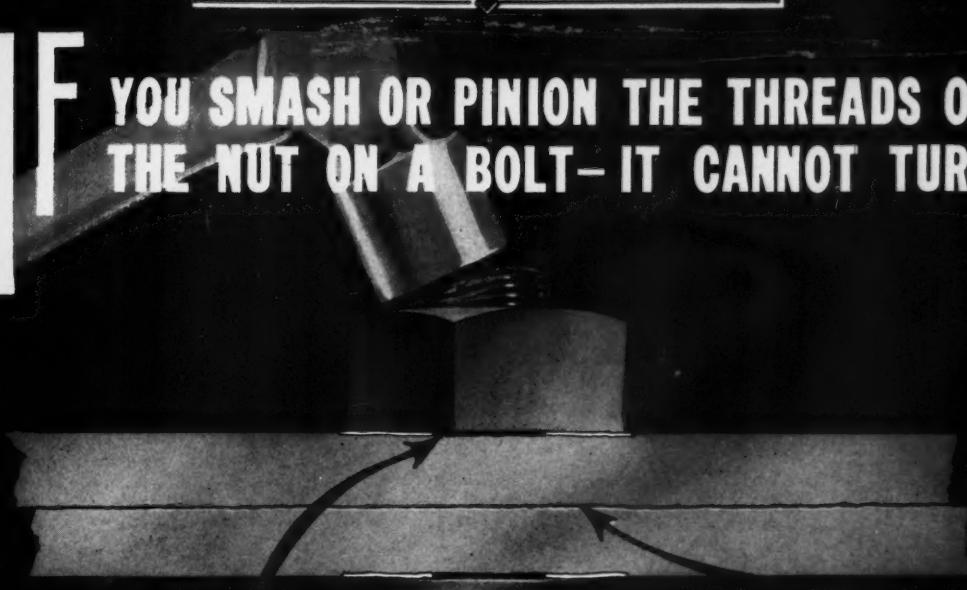


Railway Engineering and Maintenance

**IF YOU SMASH OR PINION THE THREADS OF
THE NUT ON A BOLT - IT CANNOT TURN**



but then you cannot tighten the nut down when inevitable wear loosens the parts
 and and

**ONLY A WASHER CAN COMPENSATE
FOR SUCH WEAR BY EXPANDING AND MAIN-
TAINING BOLT TENSION UNTIL THE TRACK
MAN COMES AGAIN, only a washer!**

That is why Hipower Spring Washers more than pay for themselves in reduced upkeep costs—less labor and maintenance—fewer renewals and repairs.

THE NATIONAL LOCK WASHER COMPANY, Newark, N. J.

Spring Washers • Retaining Rings • Drop Forgings • Car Window Equipment • Railway and Bus Windows

Reliance HY-CROME Spring Washers



HY-REACTION HY-CROME

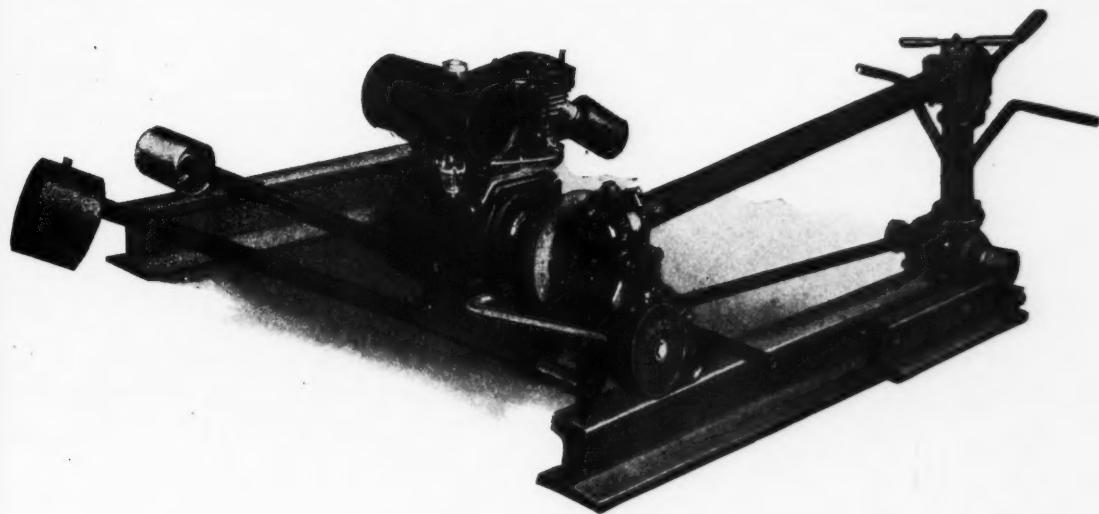
● Reliance HY-REACTION HY-CROME Spring Washers are made from a thin, parallel section of steel, and possess a wide reactive range. Where bolts are used with a finger free thread this type of spring washer compensates for looseness created through wear and prevents the nut from backing off. Specialization in railway spring washer manufacture together with extensive research conducted over a period of many years has enabled us to make spring washers to the specific requirements of the user. We are interested in your assembly problem—our sales engineers will gladly supply additional information.

EATON MANUFACTURING COMPANY
RELIANCE SPRING WASHER DIVISION
MASSILLON, OHIO



PENNSYLVANIA RAILROAD streamlined fast passenger train eastward-bound on Rockville bridge over Susquehanna River—longest stone arch bridge in the world.

Raco Power Track Machine



On **50 railroads** throughout the country **350** Raco Power Track Machines have established remarkable service records.

Its counterbalanced operating head, self-centering chucks, convenient and easy controls and the fact that it pushes or pulls along level rail with a pressure of **only ten pounds**, insure **one-man operation and make for maximum speed with minimum fatigue of operator.**

Since it weighs **only 350 pounds** it can be readily removed from the track by **two men**.

Automobile type construction and the employment of modern Chrome, Vanadium and Molybdenum alloy steels insure against **excessive breakdowns and service interruptions.**

Bolt tension is controlled within exact limits by the Raco Dynamometer and Slip Clutch. **Any tension from 1,000 pounds to 42,000 pounds is instantly available.**

RAILROAD ACCESSORIES CORPORATION

MAIN OFFICE

405 LEXINGTON AVENUE

(Chrysler Building)

NEW YORK



AMERICAN HAMMERED PISTON RINGS

EVERY
SIZE

EVERY
TYPE

FOR
EVERY
PURPOSE

The Baltimore and Ohio Railroad is a large user of American Hammered Bronze-Iron Sectional Packing. The photograph above shows the Baltimore and Ohio's "Capitol Limited", an air-conditioned train between Chicago and New York, in the valley of the Potomac.

Whether Fast Passenger
Heavy Freight, American
Hammered Cast-Iron
Bronze Sectional Packing
gives equally outstanding performance

This is a Sectional View
of the New American
Hammered Bronze-Iron
Sectional Packing.

FLANGED TYPE

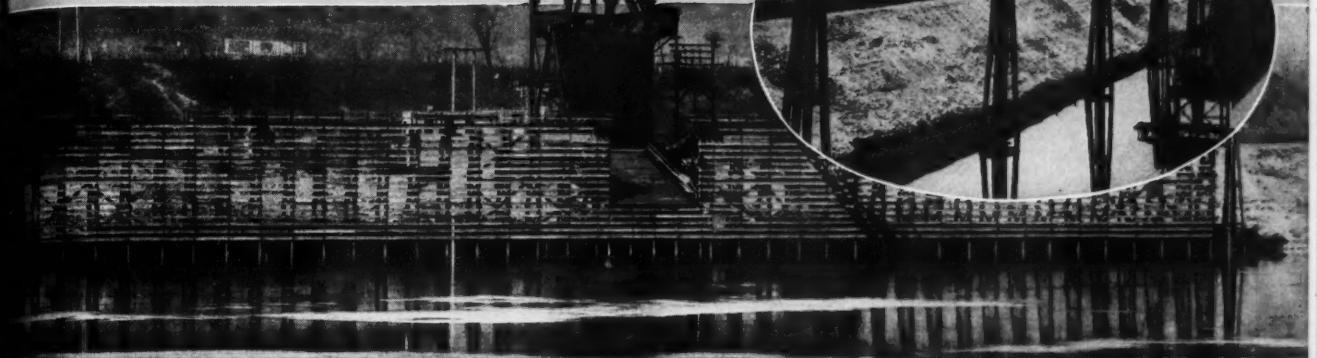
UNFLANGED TYPE

AMERICAN HAMMERED
PISTON RING DIVISION
BALTIMORE, MD.

KOPPERS

DESIGNERS • BUILDERS • PRODUCERS • MANUFACTURERS • DISTRIBUTORS • OPERATORS

KOPPERS



THE WOOD PRESERVING CORPORATION supplied Pressure-treated Creosoted Lumber for Modern River-rail Terminal

These photographs show a \$450,000 river-rail coal transfer plant built with pressure-treated lumber from the Wood Preserving Corporation, Koppers subsidiary.

The pressure-treated timber breastwork is 400 feet long, and at either end of it are 24 mooring pile clusters at which barge fleets are tied up.

THE WOOD PRESERVING CORPORATION
Koppers Building, Pittsburgh, Pa.



KOPPERS WATER-COOLED ROOFS CUT AIR CONDITIONING COSTS IN MANY WAYS—(1) Water-cooled roofs built of Koppers Coal Tar Pitch and Tarred Felt permit the use of smaller and less costly refrigerating units in air conditioning installations. (2) Two inches of water maintained constantly on the roof helps to cool the upper floors of the building and thus cuts the air-conditioning costs on them. (3) The use of the roof for cooling the water from the air-conditioning system permits the re-use of

the water and cuts water costs.

The cooling can be done either by spraying the water onto the roof, or by permitting it to flow on the roof at one point as shown in this photo. For all roofs where water is to lie in prolonged contact with the roofings, specify Koppers Coal Tar Pitch and Tarred Felt. These materials are not affected by water. Write for the specifications on the Koppers water-cooled roof.

KOPPERS COMPANY • Koppers Building, Pittsburgh, Pa.

*Koppers Divisions,
Subsidiaries and Affiliates
Serving the Railroad Field*

**THE WOOD PRESERVING
CORPORATION** PITTSBURGH, PA.

**NATIONAL LUMBER AND CREOSOT-
ING COMPANY** TEXARKANA, ARK.

TAR AND CHEMICAL DIVISION

PITTSBURGH, PA.

THE KOPPERS COAL COMPANY PITTSBURGH, PA.

**NEW ENGLAND COAL AND COKE
COMPANY** BOSTON, MASS.

BARTLETT HAYWARD DIVISION BALTIMORE, MD.

**AMERICAN HAMMERED PISTON
RING DIVISION** BALTIMORE, MD.

WESTERN GAS DIVISION FORT WAYNE, IND.

**THE WHITE TAR COMPANY OF
NEW JERSEY, INC.** KEARNY, N. J.

**THE MARYLAND DRYDOCK
COMPANY** BALTIMORE, MD.

GAS AND COKE DIVISION PITTSBURGH, PA.

*Koppers Principal Products
for the Railroad Field*

Bituminous Base Paints... Coal...

Coal Handling Plants... Coal Wash-
ing Systems... Coke... Creosote...

Deodorants... D-H-S Bronze Castings
and Iron Castings... Disinfectants...

...Fast's Couplings... Fire Hydrants...

...Insecticides... Locomotive Pack-
ing Rings... Pipe... American Ham-
mered Piston Rings... Pressure-

treated Ties, Poles, Posts, and other
Treated Timber... Roofing... Tanks...

...Tarmac for Paving... Water-
proofing... Weed Killers



These two structures are fit companions in efficient design and neat appearance—the Hayes Type WD Bumping Post and the river bridge

You may be sure that the plans for those piers were subjected to searching study before they were built; expert engineering knowledge was focused on every detail of the foundations. The superstructure was the result of equally thorough work on sections and connections from end to end.

The foundation of a bumping post is the track. A strong post will not give good service on a weak track; the track will fail and with it the post.

The middle rails at a Hayes post double the strength of the track. They pass through sockets in the rear cross-members and are thus made a unit with the post.

The cross-members at both the front and rear of a Hayes post are four inch channels of heavy section and high moment of inertia; they hold the rails to gage and prevent them from turning. They also transmit the stresses from the post to the middle rails.

The track owner furnishes the foundation. Hayes furnishes the superstructure.

Good engineering demands that both foundation and superstructure shall fully meet the requirements of use.

A track reinforced by middle rails and a Hayes Post erected on it gives a balanced structure of high efficiency.

Hayes Track Appliance Co., Richmond, Indiana

MODERNIZE TRACK with LUNDIE PLATES



and ADD 30 Per Cent to Rail Life

The Lundie Tie Plate is designed to form a scientifically correct rail bearing which gives proper inclination to rails. It presents an adjustable bearing to the base of the rail as wheel loads pass over them, thus reducing internal stresses in the rail so tending to eliminate rail fracture.

Long experience with over 200,000,000 plates in service has demonstrated conclusively that the Lundie inclined cambered plate gives rail over 30 per cent longer wearing life. And as an added economy—the Lundie Plate with its stepped, non-cutting, non-slip base holds track to perfect gauge without any tie destruction.

THE LUNDIE ENGINEERING CORPORATION

19 West 50th St., New York

59 E. Van Buren St., Chicago

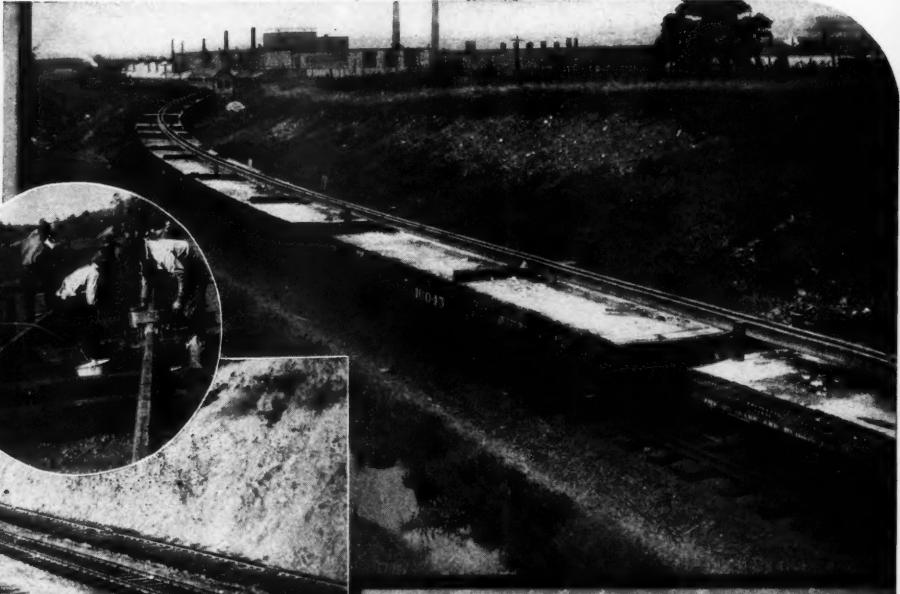
LUNDIE

TIE PLATE

Soon you'll think of RAIL LENGTHS IN TERMS OF MILES

In circle.—Welding along the right of way on the Bessemer and Lake Erie R. R. at River Valley, Pa.

Below.—Not a rail joint in sight in this mile-long stretch of track with GEO construction on the B. & L. E.



Above.—Lack of room prevented working along the right of way on D. & H. at Schenectady, N. Y. So, rails were welded into 700 ft. lengths on cars in a freight yard five miles away. The cars were then hauled to the site of installation, and the long rails unloaded, placed in track and welded together to make up 5000 and 7000 ft. stretches.

Not many years ago the advisability of increasing the standard length of rails from 33 to 39 ft. was a topic for considerable discussion. Now it seems safe to predict that rail lengths will soon be thought of in terms of miles instead of feet.

Continuous rails provide a long-sought solution to the track maintenance problem. Rails welded together into long stretches have no gaps for wheels to pound; no rail ends to batter. Joints are eliminated and joint maintenance is banished. Frequent track lining and surfacing become unnecessary. Rail life is increased; wear and tear on rolling stock and motive power reduced.

Nor, is there any doubt about continuous rails

behaving satisfactorily under all sorts of conditions. A number of jointless stretches, varying from half a mile to one and a third miles in length, are now in service on main line track. Some are on straightaways, some on curves, some level and some on grades. Several installations have been giving good service for two and a half years. On the Delaware & Hudson, welded rails have been installed with M. & L. construction; on the Bessemer & Lake Erie, with GEO; and, elsewhere, with ordinary double-shoulder tie plates.

It will pay you to investigate. Write now for information, or, ask to have our nearest representative call and give you the complete story.

THERMIT *Rail* WELDING

METAL & THERMIT CORPORATION, 120 BROADWAY, NEW YORK, N. Y.
ALBANY • CHICAGO • PITTSBURGH • SO. SAN FRANCISCO • TORONTO



No ballasting gang can keep up with the
NORDBERG POWER JACK

On this ballasting job, a Nordberg Power Jack with its operator and four tampers easily stays ahead of the tamping gang.



Three advantages of the Nordberg Power Jack are readily apparent—*speed, saving of labor and accuracy*. Track can be lifted faster than it can be tamped. When compared with hand methods, less than one quarter the number of men are required for lifting track in order to maintain the same speed. The lift can be controlled to a fraction of an inch and closer alignment maintained. There is no time lost for the resetting of jacks, neither is the track thrown out of line due to the kicking out of the jacks. Wherever track is ballasted or surfaced, the Nordberg Power Jack is a necessity for rapid progress, lower cost and better track.

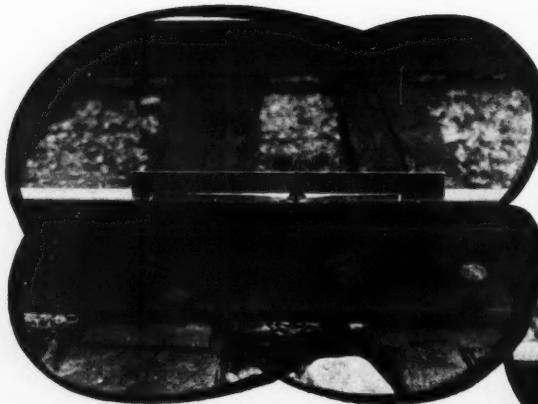
Nordberg Power Tools for All Maintenance Jobs!

Adzing Machine	Spike Puller
Power Jack	Surface Grinder
Power Wrench	Precision Grinder
Rail Drill	Utility Grinder
Track Shifter	

NORDBERG MFG. CO., MILWAUKEE, WIS.

An Unbeatable Combination

TELEWELD

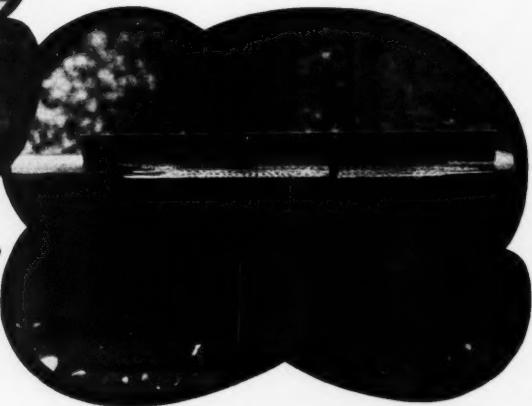


BEFORE and AFTER →

Showing rail ends before and after being built up by TELEWELD Process

RAIL END WELDING JOINT BAR SHIMS

Services that build up, strengthen and provide tight joint bars, so important in securing smooth riding rail and affording economical maintenance.



The TELEWELDER, a portable power plant, is set off the track at one mile intervals, A MILE AT A TIME is welded with no interruption to traffic.

The TELEWELD pre-heating process places the rail in a receptive condition for the weld deposit and controlled cooling definitely limits and controls the hardness.

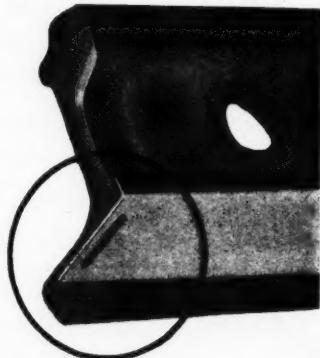
Weld is ground to true surface with special TELEWELD Grinder.

Beveling and cross cutting completes the operation. The finished job provides reconditioned and heat treated rail ends superior to original rail.

TELEWELD

Joint Bar Shims Automatically correct all worn areas and restore joint bar efficiency.

Designed to fit under joint bar and over rail base providing a complete new bearing and correcting all worn areas. Low cost but high efficiency.



TELEWELD, INCORPORATED

RAILWAY EXCHANGE BUILDING, CHICAGO, BRANCHES IN PRINCIPAL CITIES

New Rail End Hardening—Rail End Restoration—Manual Rail Slotting Equipment—Frog and Switch Reclamation—Steel Bridge Reinforcement; Teleweld Patented Joint Bar Shims—Teleweld Portable Brineller

It can't Happen here!

...the costly accident that comes
from lack of proper fencing



WITH train schedules stepped up, good right-of-way fencing becomes more important than ever!

American railroads find that sturdy American Railroad Fence and husky American Banner Steel Line Posts are a combination that pays dividends far in excess of their cost.

They reduce accidents. Prevent the expense and ill will caused by injury to live stock. And they save you

money on repair and replacement costs because they're built to *last*.

American Railroad Fence is made of rust-resisting copper bearing steel—smoothly and heavily coated with galvanizing. Wire is medium hard, with just the right "spring" to it. The famous American Hinge Joint has the flexibility necessary to resist the pressure of live stock.

One man can drive several hundred

American Banner Steel Posts in a day. The patented slit wing anchor locks each post in the ground as solid as a rock. Used with National Expanding Anchor End and Corner Posts (dirt set) they make a fence foundation that can't be beaten.

Complete information on proper fencing of right-of-way, around shops and buildings, at stations and in yards will be sent to you upon request.

U·S·S AMERICAN RAILROAD FENCE and STEEL POSTS

AMERICAN STEEL & WIRE COMPANY, Cleveland, Chicago, and New York

COLUMBIA STEEL COMPANY, San Francisco

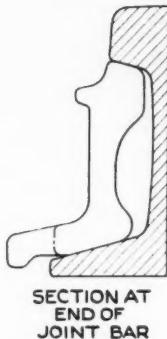
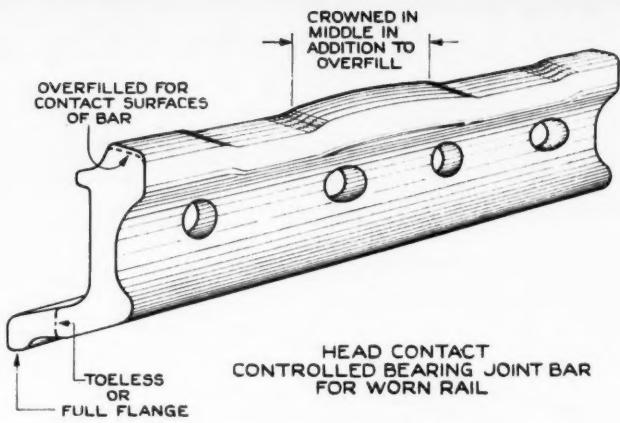
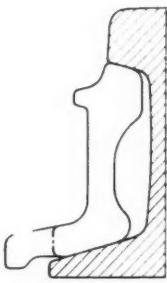
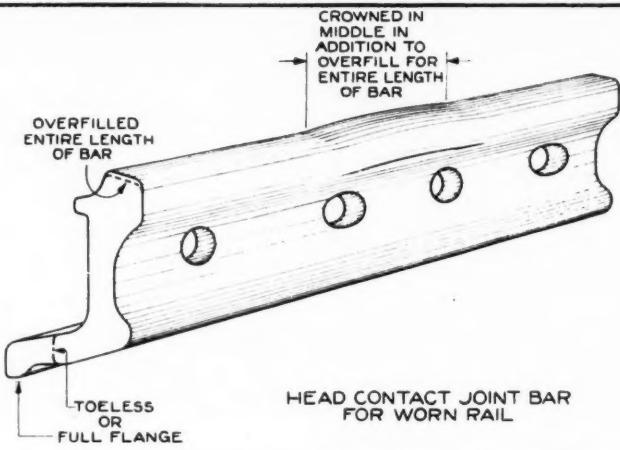
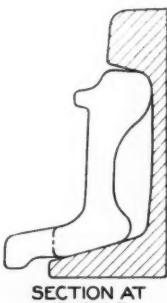
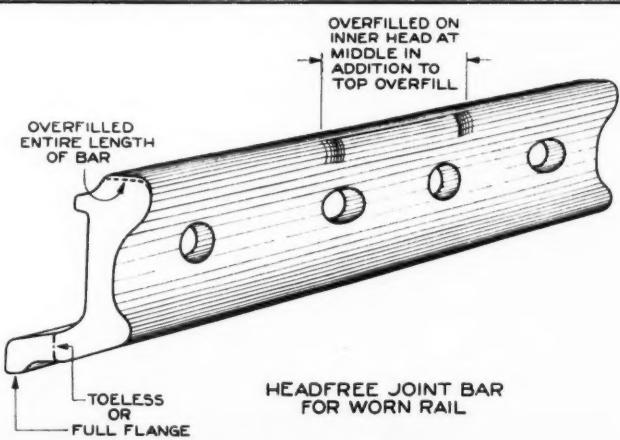
TENNESSEE COAL, IRON & RAILROAD COMPANY, Birmingham

United States Steel Products Company, New York, Export Distributors



UNITED STATES STEEL

NEW JOINTS FOR OLD RAIL

SECTION AT
END OF
JOINT BARHEAD CONTACT
CONTROLLED BEARING JOINT BAR
FOR WORN RAILSECTION AT
END OF
JOINT BARHEAD CONTACT JOINT BAR
FOR WORN RAILSECTION AT
END OF
JOINT BARHEADFREE JOINT BAR
FOR WORN RAIL

WE WILL GLADLY MAKE A STUDY OF YOUR TRACK CONDITIONS
AND RECOMMEND THE MOST SUITABLE TYPE OF JOINT

The Rail Joint Company, Inc.

50 Church Street

New York, N. Y.



AIRCO

WELDING PRODUCTS

have
Universal Applications
in the
Maintenance-of-Way
Department

THE ever-increasing applications of oxyacetylene operations in Maintenance-of-Way work largely owe their present high degree of perfection to major developments of AIRCO PRODUCTS and AIRCO TECHNIQUE.

- The AIRCOWELDING process of reconditioning battered rail ends is, for example, now *standard* on many leading roads.
- The AIRCO method of heat-treating and reforming rail ends shows that rail end batter can be prevented.
- Welded Track Bonds are rapidly replacing wire bonds. As a result, train delays are being decreased and operations improved.
- Frog and Switch Point reclamation by the gas torch effect tremendous savings.
- Pipe welding, repairs to bridges, track tools, switch stands, motor cars, water tanks and many other miscellaneous jobs also effect worth while savings in time and money.

AIRCO engineers gladly offer complete AIRCO facilities in any welding studies or problems that may confront you.

AIR REDUCTION SALES COMPANY

General Offices: 60 East 42nd Street, New York, N.Y.
DISTRICT OFFICES in PRINCIPAL CITIES

A NATION-WIDE WELDING and CUTTING SUPPLY SERVICE



● New possibilities in track work were given the railroad world, with the arrival of BARCO Tytampers.

A demon for work and a Scotchman for economy . . . the Barco Unit Tytamper combines speed, power, and portability. The entire unit can be moved from place to place by one man. There is no time-wasting makeready for cumbersome auxiliary power plant. Yet the BARCO has ample power for the hardest maintenance jobs. In spot or gang tamping it drives ballast

under the ties with enough force to maintain rails and joints at proper level. It cleans up the toughest crib busting jobs in record time.

Equally efficient whether used separately or in large gangs.

Write all detailed questions to us, for reply from facts accumulated on actual jobs.



BARCO MANUFACTURING COMPANY • 1805 W. Winnemac Ave., Chicago, Ill.
IN CANADA • THE HOLDEN CO., LTD.—Montreal—Moncton—Toronto—Winnipeg—Vancouver

BARCO UNIT TYTAMPER



The RACOR
RAIL LUBRICATOR
distributes the
RIGHT AMOUNT OF GREASE
in the RIGHT PLACE

The entire circumference of the flanges of thirty-three inch wheels are coated with an evenly distributed film of grease. This insures a maximum delivery of lubricant to protect curves for several miles distant from the lubricator, with a minimum wastage on tangent track.

Thus, longer life for rails and wheels is assured, with consequent reduction in maintenance costs. The savings effected on rail and wheel purchases alone will pay for the lubricator in a very short time.

It is sturdily built. Operating parts are of substantial construction with flexible connections. It needs little attention. It is only necessary to keep the reservoir filled and the few exposed parts oiled.



RAMAPO-AJAX CORPORATION

CANADIAN RAMAPO IRON WORKS, LIMITED

General Offices: 220 Park Avenue, N. Y.

Racor Works: Hillburn, New York • Niagara Falls, N. Y. • Chicago, Ill.
 East St. Louis, Ill. • Superior, Wis. • Pueblo, Colo. • Los Angeles, Cal. • Seattle, Wash. • Niagara Falls, Ont.

No. 104 of a series

Railway Engineering and Maintenance

SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: Chewing Gum and Railway Supplies

August 1, 1937

Dear Reader:

A friend told me a story a few days ago that bears so directly on the problems of those of you who manufacture materials and devices for use in railway maintenance—and also to those of you who select and use such products—that I want to repeat it to you. According to this story (and I have verified its accuracy), Wm. K. Wrigley of chewing gum fame was riding on one of our fine trains when a man sat down beside him and introduced himself as a stockholder in Mr. Wrigley's company. Pressing the conversation, this man told Mr. Wrigley that he had long wanted to suggest to him a way to save \$1,000,000 for the company. Asked to be specific, the man replied that he would reduce the advertising expenditure by that amount.

Turning to the window for a moment, Mr. Wrigley then asked his friend how fast he thought the train was traveling. "Oh, about 70 miles an hour," the friend replied. "Then," continued Mr. Wrigley, "what would happen if the fireman on the locomotive drawing the train should cease adding coal on his fire?" "The train would probably continue at its present speed for a short time," the stockholder replied, "and would then gradually slow down until it came to a stop." "That's right," said Mr. Wrigley, "and the \$6,000,000 that we spend for advertising each year is the 'fuel' that is keeping Wrigley chewing gum so far ahead of its competitors."

By this simple illustration, Mr. Wrigley gave the basic reason for his spectacular success in a field that was already well served before he appeared. And the value of liberal, continuous advertising is as great in the marketing of railway materials and equipment as for chewing gum. Look through the pages of this issue and note the advertisements of those companies whose names are synonymous with leadership and success in the field of railway maintenance. Is not regular use of these pages evidence of their belief that advertising is the "fuel" that generates sales of maintenance materials and equipment?

Yours sincerely,



Editor

ETH:EW



A crossing that can take it

FOR one of railroading's toughest jobs Bethlehem has a product that will give both longer life and lower maintenance costs. It is the Heat-Treated Crossing—a crossing built up of rails which have been hardened their full length by accurately controlled treatment, yet have retained a full measure of the ductility so necessary to absorb the shock of fast-rolling wheels.

Crossings require about the ultimate in shock-absorbing capacity. Wheels of a fast-moving train jump across the flangeway and land with terrific impact on the opposite crossing corner. Tests show that during the last few years higher speeds and greater loadings have more than doubled the force of the blows.

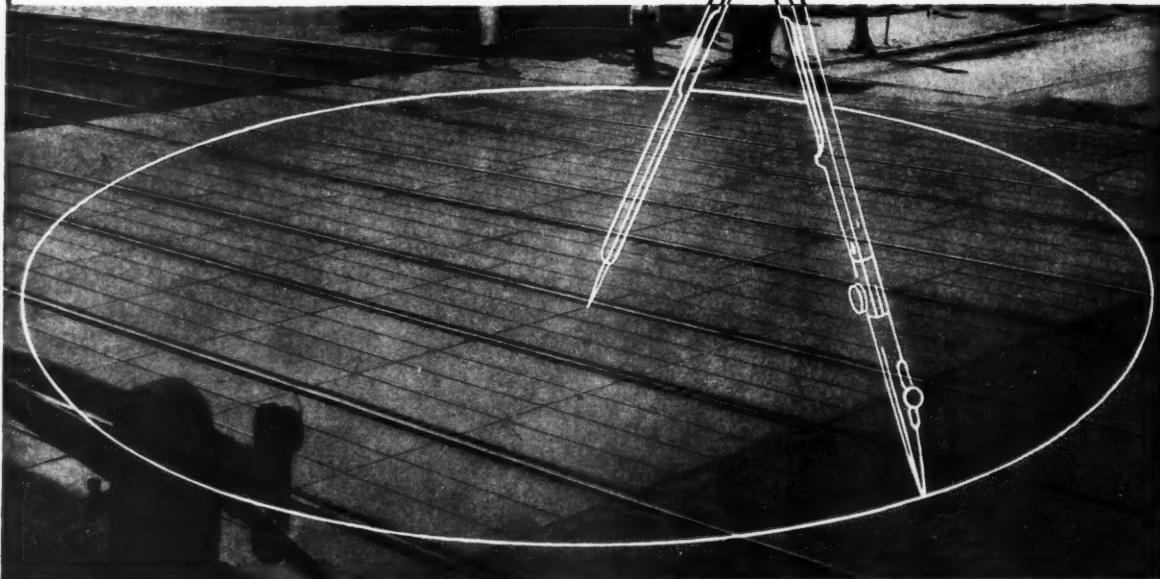
Because wear amounting to as little as one-eighth of an inch will still further double the pounding, the steel must be hard. Yet without some elasticity the severe shock and jar would quickly wear away or flatten out the hardest steel.

The Heat-Treated Crossing, as Bethlehem makes it, gives the best combination of physical properties yet achieved for this job. Compare the 361 average Brinell hardness of the heat-treated rail with the 282 average for standard carbon rail steel; with the initial hardness of about 225 for the solid-manganese casting. Compare service records. Experience with heat-treated crossings has shown that they wear less than half as rapidly as crossings made of manganese steel.



BETHLEHEM STEEL COMPANY

ENCOMPASSING TODAY'S CONDITIONS



TRUSCON WELTRUS HIGHWAY CROSSINGS

Maintenance of way departments of American Railroads lead the world in their attack on the growing menace of obsolete highway crossings. Truscon engineers are cooperating in all instances where traffic conditions demand the *permanent, economical* solution provided by Truscon Weltrus Highway Crossings. • Made of copper bearing rolled steel channels, Weltrus welded steel units are filled with concrete to provide double wearing surfaces. Not only do Truscon Weltrus units completely armor the concrete on all sides but the flanges carry the traffic over on the wearing surface of

the concrete. • Truscon Weltrus Crossings are made to fit any rail height and are furnished in any length to meet any requirement. There are no "trick" fastenings. Installation is easy. They require practically no maintenance and are easily removable for track repair work. • When the determining factors include comparative initial costs, maintenance costs, and life of the crossings under consideration, Truscon Weltrus Crossings are found to cost less per square foot on an annual basis. • For specific details, communicate with the nearest of Truscon's 57 Sales-Engineering Offices or write direct to . . .



TRUSCON
Steel company
YOUNGSTOWN . . . OHIO



Published on the first day of each month by the

SIMMONS-BOARDMAN PUBLISHING CORPORATION
105 West Adams Street, Chicago

NEW YORK
30 Church Street

CLEVELAND
Terminal Tower

WASHINGTON, D. C.
1081 National Press Bldg.

SEATTLE
1038 Henry Bldg.

SAN FRANCISCO
485 California Street

LOS ANGELES
Union Bank Bldg.

Samuel O. Dunn, *Chairman of the Board*; Henry Lee, *President*; Lucius B. Sherman, *Vice-President*; Cecil R. Mills, *Vice-President*; Roy V. Wright, *Vice-President and Secretary*; Frederick H. Thompson, *Vice-President*; Elmer T. Howson, *Vice-President*; F. C. Koch, *Vice-President*; John T. DeMott, *Treasurer*.

Subscription price in the United States and Possessions, and Canada, 1 year \$2, 2 years \$3; foreign countries, 1 year \$3; 2 years \$5. Single copies, 35 cents each. Address H. E. McCandless, Circulation Manager, 30 Church Street, New York, N.Y.

Member of the Associated Business Papers (A.B.P.) and of the Audit Bureau of Circulations (A.B.C.).

Railway Engineering and Maintenance

NAME REGISTERED U. S. PATENT OFFICE

August, 1937

Editorials	529
Land Grants—Winter—Refinements—Building Repairs—Rail Conservation	
Making Rail Last Longer	532
Missouri Pacific has given special attention to plan for co-ordination of measures for systematic conservation	
Use Second-Hand Steel in Wood Trestles	536
Southern Pacific Lines applies second-hand beams as caps and, in some cases, also as stringers on pile bent structures	
Do Higher Speeds Increase Labor Costs?	538
A.R.E.A. committee reports on investigation to determine influence of faster schedules on volume of maintenance work required	
Catching Up on Building Maintenance	540
Wabash carries out program of repairs and painting to improve condition and appearance of many structures on its lines	
Welding Special Trackwork	543
S. E. Tracy tells how the Burlington handles this operation and explains why he favors repairing frogs and crossings in track	
Wood Preservations Statistics for 1936	545
Compilation shows 24 per cent increase in treatment compared with 1935. Gain for crossties was 10 per cent and for switch ties 9.8 per cent	
What's the Answer?	547
New Products of the Manufacturers	554
New Books	555
News of the Month	556

ELMER T. HOWSON
Editor

WALTER S. LACHER
Managing Editor

NEAL D. HOWARD
Eastern Editor

GEORGE E. BOYD
Associate Editor

M. H. DICK
Associate Editor

F. C. KOCH
Business Manager

STRENGTH, EFFICIENCY AND LOW COST



assured by Welded Pipe Joints

OXY-ACETYLENE welding is widely used in the construction, expansion and alteration of piping systems in shops, roundhouses and similar railroad properties.

The properly made welded joint is efficient—because it is strong and leakproof for the life of the pipe. It is economical—because welded lines can be installed at low cost, and future joint maintenance is eliminated. It is adaptable—because oxy-acetylene welding can be used on any metal, on any size of pipe and for any type of piping service.

Oxweld procedures for pipe welding include

techniques which are the most modern developments in pipe welding as applied to railroad work. When planning piping installations or alterations, railroads under contract for Oxweld Railroad Service should avail themselves of the profitable use of these widely utilized Oxweld procedures.

THE OXWELD RAILROAD SERVICE COMPANY
Unit of Union Carbide and Carbon Corporation

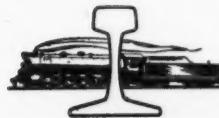
New York:
Carbide and Carbon Building

Chicago:
Carbide and Carbon Building



1912-1937
A QUARTER OF A CENTURY OF SERVICE
TO THE MAJORITY OF CLASS I RAILROADS

Railway Engineering and Maintenance



Land Grants

Versus Highway, Waterway and Air Subsidies

IN THESE days when an increasing proportion of the public is becoming alert to the unfairness of the competition to which the railways have been subjected during the last few years by reason of the financial aid given, through public subsidies, to their competitors on the highways, on the waterways and in the air, the rejoinder is frequently made by the partisans of these agencies that they are receiving only the same aid that was given the railways in their early days in the form of land grants. Because of the widespread prevalence of this impression, it is well to review the facts.

Land Grants

Let us look at these land grants. The first grant was made to the Illinois Central in 1850 to aid in the construction of 705 miles of lines in Illinois. The road received 2,595,000 acres of public lands in the form of alternate sections along the route of the railroad. At the time this grant was made, approximately 11,500,000 acres of public lands in Illinois had been on the market at \$1.25 per acre from 15 to 30 years without purchasers, and the price had finally been reduced to 12½ cents per acre. Yet, after the railroad was built, the government was able to sell its remaining half of the land readily for \$2.50 per acre. In reality, therefore, the government was able, by means of this land grant, to convert an unsalable liability into a readily salable asset—and that at an immediate profit.

Again, it may be pointed out that in 1860, the total population in the seven states of Minnesota, North and South Dakota, Oregon, Idaho, Montana and Washington, the states opened up by the land grant to the Northern Pacific, was only 240,969, while the population of the states of Kansas, Colorado, New Mexico and Arizona (opened up by the land grants to the Santa Fe) was only 234,999. From these figures it can be seen that there was insufficient population in this western area to justify the building of the railways and little prospect of increasing this population so long as there was a lack of transportation facilities. Congress recognized the fact that if the government was to dispose of its lands to settlers, they must be preceded by the railroads. These land grants were, therefore, investments on the part of the government, designed to increase the value of its remaining investment in public lands. It was this principle that led to

the offering of aid, in the form of grants of land, usually alternate sections for a distance of six miles back from the line, to the railways that dared venture into the great open and largely unsettled areas of the west.

Loans

For six roads, principally the Union Pacific and the Central Pacific, direct financial aid was also given in the form of loans. Even though all of these roads went into bankruptcy, and their original stockholders lost all or a part of their investments, all but one repaid the government the principal in full and three paid the interest in full, the repayments aggregating \$64,623,512 in principal and \$116,508,388 in interest, or 93.4 per cent of their total obligations, including interest.

In all, some 15,316 miles of lines, or less than 7 per cent of the total mileage of the country, were built with the aid of land grants. The land thus turned over to the railways totaled about 132,504,000 acres, which, based on other sales of those days, had a total value of \$124,000,000. In return, the government was enabled not only to dispose of its remaining lands at sufficiently increased prices to more than make good the gifts, but it secured concessions in rates from these land grant roads, good for all time, that have resulted and are still resulting in further large economies.

These concessions include the transportation of the mails over these land grant lines at 80 per cent of the full tariff and the transportation of other freight and passengers at 50 per cent reduction. Still other special provisions were written into the contracts with some of the roads. On the Illinois Central, for illustration, the state of Illinois will collect perpetually a special annual tax of 7 per cent of the gross earnings on these land grant lines, a tax materially in excess of those which would otherwise be levied.

From the land grant railways as a whole, the government is saving normally at least \$5,000,000 a year, including \$2,000,000 for transportation of the mails, or sufficient to repay the entire loans every 25 years. The Illinois Central paid more than \$21,000,000 in special taxes and deductions for handling government supplies and materials prior to June 30, 1915 in return for land which it could have purchased at the time of the land grants for \$3,100,000. And the Burlington repaid the value of its land grants five times prior to 1920.

Nor is this the full story, for in the last three or four years the government has made still greater savings, at the expense of the railroads, through the movement of vast quantities of materials for projects for the relief

of unemployment. During the years 1934-5 alone, the savings to the government in rail transportation charges on materials and troops approximated \$8,000,000, to which there is to be added \$2,000,000 more per year for reduced cost of carriage of the mails.

Contrast with Other Agencies

Now let us look first at the highways. Built and maintained by the public, they provide the right of way and roadbed over which buses and trucks operate in competition with the railways on payment of license fees and gasoline "taxes" that fall far short of compensating the public for the destruction of roadway and the amortization of the construction cost, let alone contributing to the support of government at large. As for the waterways, the government is deepening and maintaining channels (right of way and tracks) free of all expense to users. Likewise in the air, the government is providing special weather information, is lighting the main routes for night flying and otherwise assisting the operators, all without cost to them. Furthermore, as with the waterways, the municipalities are providing terminal facilities (docks and air ports) free or at nominal cost.

In all of these services, the public contribution is increasing by leaps and bounds, with no provision for ultimate recovery in whole or in part. In this respect, the subsidies to these competitors of the railways differ widely from the land grants to the railways, which not only returned handsome profits to the government immediately through the ability to sell the land remaining at much higher prices, but are still yielding, and will perpetually yield, to the government a liberal return in the form of reduced costs for the transportation of materials, troops and mail.

This is a fundamental distinction that the public at large should realize. Railway employees can do much to promote this understanding by disseminating the facts.

Winter

What Buildings Need Attention?

IT IS not too early to study the needs of the coming winter, especially as they concern the requirements of buildings. Ordinarily, these are founded on the experience of the previous winter, but because last winter was such a mild one in most parts of the country any conclusions based on a review of last winter's observations may easily lead to a false sense of security. It is better, therefore, to review the instances of inadequate heating during the severe winter of 1935-36, and make a check of the extent to which corrective measures have been undertaken since.

It is trite, of course, to say that each individual case must be considered on its own merits. Nevertheless, this is absolutely true in studying the needs for improved heating. In some cases, a thorough overhauling of the existing plant may be all that is needed. In others a larger stove may be the only practical answer, while in still others there is an obvious demand for a new and more modern heating system.

On the other hand, the fault may not lie with the means of heating at all, because the real need may be for improved insulation. And in view of the extent to which home owners are reducing their fuel bills by expenditures for insulation it is reasonable to assume that the cost of heating many railway buildings, especially small stations, could be similarly curtailed.

Railways are at a disadvantage, compared with their competitors, because the stations are older and, obviously, they cannot afford to replace or even modernize all these structures, simply because most of the facilities provided by bus lines and air lines are newer and more up to date. However, this disadvantage should be overcome as rapidly as possible and in the meantime, it is up to the railroads to assure a degree of comfort in their stations that is, in a measure at least, commensurate with that which is offered on the trains.

Refinements

What They Mean in Building Treated Trestles

THE open-deck pile trestle has been employed more extensively than any other type of bridge in use on American railways. Like other structures required to support the weight of trains, it has been subjected to changes in design for the purposes of increasing its strength as the live loads have been increased, and certain elements of earlier designs, as for example the corbels, have been eliminated. The practice of mortising, a source of weakness rather than strength, has long since been abandoned, but for nearly a third of a century open deck trestles in use on the various railways have differed only as to minor details.

In view of this it is not immediately apparent why a number of the railways have revised the designs for these structures during the last three or four years, but mature consideration shows that there are several good reasons for making changes in these structures. Foremost among these is the trend toward the use of treated wood in open deck trestles which had previously been confined largely to ballast deck structures, coupled with a realization, based on experience with older structures, built of creosoted wood, that field cutting of the wood produces focii for early decay. Because it soon became evident that instructions to field forces to avoid unnecessary cutting of timbers in the field were of little avail since a certain amount of framing could not be avoided, some of the roads endeavored to preframe trestle timbers. However, brief experience in this direction pointed to the need for changes in design that would simplify the problem of preframing. In other words, it was necessary to develop details for connections that would permit of some leeway in field assembly. Among the innovations that have been introduced is the substitution of various other means of securing the stringer chords to the caps, since it is next to impossible to prebore holes for bolts that could be counted on to match in the field.

However, in spite of these changes in design, preframing calls for more exacting work on the part of the field forces. It is necessary to locate bents with greater accuracy and apply greater skill in driving piles because pre-

framing in most cases does not permit of as large tolerances in the position of the caps as is allowable where the decks are field framed. Furthermore, there is need for greater refinement in other phases of field practice, regardless of the changes made in design. The pressure treatment of bolt holes necessarily bored in the field is rapidly becoming a standard requirement, as is the thorough treatment of the cut-off faces of piles. Avoidance of rough handling in the unloading or moving of the timbers and the use of scaffold rigs that do not require the driving of spikes are also worthy of mention.

To sum up, the requirements for successful erection of prefabricated structures and the precautions necessary to preclude abuse of treated wood demand a degree of refinement of trestle construction that would have been deemed the height of fussiness a quarter of a century ago. But the answer to this is that the structure of earlier days was expected to last only 6 to 10 years, while the trestle built today of treated wood should last 30 years, providing the so-called refinements mentioned above are carried out.

Building Repairs

Are Quality and Economy Compatible?

DURING the depression, expenditures for the upkeep of railway buildings, because they were not necessary to insure the safety of travel, suffered more drastic curtailment than any other class of maintenance expenses. As time passed the effects of this lack of attention became sufficiently manifest to arouse considerable criticism of the railroads from both public and private sources. Confronted with this situation, most railroads have become convinced of the necessity of improving the appearance of their structures, particularly passenger stations, as quickly as possible. As a consequence, as funds for maintenance purposes have become more plentiful, many carriers have undertaken relatively larger programs of building repair and maintenance.

Notable among these is that of the Wabash, which is described in detail in an article beginning on page 540 of this issue. The program of this road is of interest primarily because it has been prosecuted in such a manner as to demonstrate that the making of building repairs having a high degree of durability and attractiveness is entirely compatible with economy. To achieve this end full advantage was taken of the savings to be accomplished by conducting the work out-of-face with efficiently organized, yet flexible, gangs. Moreover, during the planning of the program, every phase of the operations of the gangs was scrutinized closely in a search for opportunities to reduce costs without sacrificing durability or attractiveness. Reflection of this scrutiny is seen in the decision to eliminate certain of the smaller buildings, in the efficient manner in which the materials for repairs were distributed and in the painting of roadway signs, which was carried out hand in hand with the other work.

The painting operations offered a particularly fertile field for the introduction of improved practices. These included spray painting, and in order to derive the maxi-

mum benefits from this practice the company revised its painting standards to reduce the amount of hand work in painting trim, this being accomplished without the sacrifice of appearance. That economy was not the sole consideration influencing the choice of painting practices is indicated by the fact that all paint that is badly deteriorated is burned off, utilizing a type of gas that has not heretofore been employed for this purpose. Other railroads contemplating extensive building repair programs will profit by a study of the methods now in vogue on the Wabash.

Rail Conservation

Extent of Its Development in Recent Years

PROGRESS usually develops slowly and at far from a uniform rate; in other words, periods of intensive activity are followed by quiescent periods, sometimes of considerable length, during which apparently little progress is being made. Yet, as a rule, the so-called quiescent periods are misleading, for quietly beneath the surface forces are at work or studies are being made which eventually result in spectacular developments that produce the seemingly greater rate of progress.

A case in point is the care of rail. From the earlier days of the railways much time and effort have been expended in seeking ways to increase the life of rail in both its primary and secondary service. Since the condition of the rail ends has always been the limiting factor in the life of rail for main-track use, much attention has been paid to the joints. In the days of iron rail these efforts were directed largely to means for supporting the rail ends, chairs being the most favored device. When steel superseded iron for rails, the design of joint fastenings came under closer scrutiny but it was not until rail sections became higher that a real opportunity was presented to improve joint fastenings.

This was followed by a period when progress in improving rail-end conditions seemed to stand still, although during this period rail sections became heavier, joint design was improved and the ends of released rail were sawed to condition it for relaying. In the meantime, heat treatment of steel was being developed and shop welding came to be common practice. When it was discovered that heat treatment and welding could be applied to rail in the field, progress in caring for rail entered a new period of accelerated activity which today is more intensive than ever before.

Stimulated by these developments maintenance officers have found other means of conserving rail and have learned also that some of the devices which they had been using for other purposes have conservation features that were discovered only through their influence on the primary rail conservation work. Descriptions of the rail-conservation methods that are being followed by a prominent western railway appear on succeeding pages of this issue. A similar description of the methods employed by an equally prominent eastern road will appear in September. These articles are of particular interest in that they show the extent to which rail conservation has been developed within a relatively short time.

Making Rail Last

on the Missouri

Beginning in a small way 12 years ago with the building up of battered rail ends by welding, rail conservation has become settled practice on the Missouri Pacific, which has been expanded to include compensation for wear on the fishing surfaces, the hardening of rail ends, the use of track devices which were originally designed and are still used for other purposes, and the protection of the rail against corrosion. All of these practices have been co-ordinated to produce a comprehensive plan of conservation which is being applied consistently over the system, and which is scheduled as a part of the annual maintenance program.

RECOGNIZING the economic advantage of extending the life of rail by every means compatible with reasonable cost, the Missouri Pacific has given special attention to the development of practices of rail conservation which it is applying on a system-wide basis. These practices begin with the laying of the new rail, and are employed thereafter as needed to insure maximum life and to minimize the abuse which is inherent in the service which rail must perform.

Included among the measures which are now being carried out as standard practice on this road are the hardening of the ends of all new rail, the building up and heat treating

of the ends of battered rail, the renewal or shimming of worn joint bars, the grinding of adjacent rail ends to bring them to the same elevation, the cross grinding of all hardened and welded rail ends, the maintenance of bolts to a uniform tension, the use of larger tie plates with independent fastenings, extensive installations of GEO track, more intensive use of anti-creepers, the use of rail and flange lubricators on curves, the oiling of the rail and fastenings on lines subject to brine drippings and the testing of the rail at regular intervals to detect the presence of internal fissures and other defects before they result in failure of the rail.

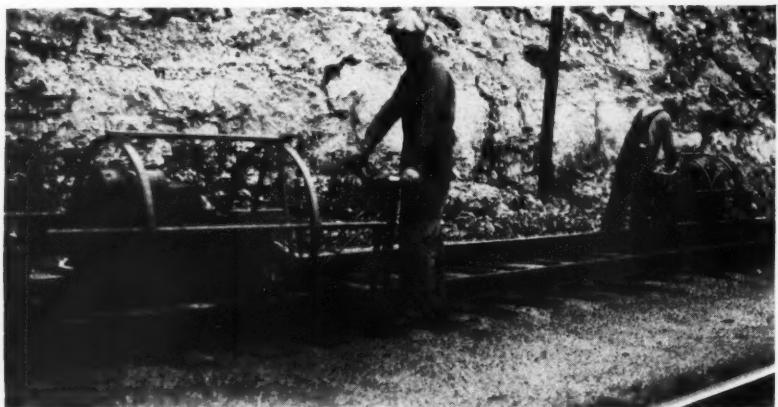
While none of these measures is original with the Missouri Pacific or owes its major development to this road, the comprehensive program of rail conservation which has been

adopted, the manner in which the foregoing measures have been co-ordinated to produce maximum benefits and the consistency with which the program is being carried out are of direct interest to every man engaged in track maintenance.

Starts With New Rail

While the conservation program now starts with the laying of the new rail, this was a later development, some other of the measures which have been mentioned having been adopted previously. Again, some of the practices that are being followed were not developed originally to conserve the life of the rail, but had their inception in other objectives and came to be looked upon as rail-conservation measures only after their relation to this feature of maintenance had been discovered later. For these reasons, a

Below—Bolting with Mechanical Nut Runners Has Been Made a System Operation. Right—The Electric Process in the Building Up of Rail Ends Is Used Extensively



better idea can be gained of the practices as they are applied on this road by starting with rail that has been in service a sufficient time to require attention. The measures as they are then applied are corrective, while those for the new rail are largely preventive and have grown out of ex-

Last Longer Missouri Pacific



Left—Most of the Rail End Welding Is Done by the Oxy-Acetylene Process. Above—Typical Main Line Track on the Missouri Pacific

perience with rail that has been subject to normal wear as well as with that which has been subject to unwarranted abuse.

Anti-Creepers Conserve Rail

Probably the oldest practice of those mentioned is the use of anti-creepers. Originally, it was believed that four anchors to the panel were sufficient and for a number of years only four were used, and they were applied to resist movement in one direction only. The direction of preponderant tonnage often changed, however, and sometimes on single track this completely nullified the benefits that were expected to accrue from the use of anti-creepers. Similar difficulties were not experienced on double track until these tracks were signaled for operation in either direction, after which there were many instances where the reversal of traffic caused the rail to creep in the direction opposite that for which it had been anchored.

Obviously, where traffic or tonnage was reversed from time to time it was not possible to maintain a uniform expansion allowance, or any expansion allowance in some cases, or to

control the movement of the rail with anti-creepers as then applied. This led to the decision to anchor the track against movement in both directions on all lines where these conditions existed. As a result, eight anti-creepers were applied to a panel, four each way, and this is still the practice for all rail equipped with slotted angle bars.

More recently unslotted angle bars have been used, and still more recently the toeless type of joint bar, of the Rail Joint Company's symmetrical design, was adopted as standard. It was soon found that, since these joint fastenings do not of themselves offer resistance to rail creepage, eight anti-creepers are insufficient to hold the rail against all movement. Accordingly, two anti-creepers for each direction were added to each panel, making 12 in all, and this number is now standard on all primary lines of the company, except where the joints are slot-spiked.

Rail anti-creepers have been and are today used by the Missouri Pacific for exactly what their name implies. They were used for many years primarily to eliminate the evils of irregular line, uneven surface, unequal gage, slued ties, disturbed ballast and

kinked track, which attend rail creepage, but with no thought that they bore any important relation to the life of the rail to which they were applied.

While rail batter had been a major problem in maintenance ever since T-rails came into use, and while it had long been recognized as one of the limiting factors in the life of rail, it was not until the building up of battered rail ends by welding came into vogue that attention was directed specifically to the rate at which batter occurs, and to its cause. These studies, which were undertaken independently in many quarters, showed unmistakably that, among other causes, too much or too little expansion and lack of uniformity in the amount of expansion affect the rate of batter and that the damage, including chipped rail ends, that can be traced to this cause can be minimized by controlling the movement of the rail to keep the expansion allowance uniform and within allowable limits. Experience has shown that a simple and effective means for doing this is to apply sufficient anti-creepers to prevent movement of the rail in either direction. Today, on this basis, the Missouri Pacific looks upon the use of anti-creepers as a necessary measure to reduce the rate of joint batter and, therefore, as an important conservation measure.

Welding Backbone of Program

Welding to build up battered rail ends, undertaken originally partly as a conservation measure, that is with a view to obtaining additional service

life from worn rail, but more particularly to improve the riding condition of the track, has become the backbone of the conservation program followed by the Missouri Pacific. Although only a small amount of spot welding, largely for experimental purposes, had been done here and there on the system prior to 1926, the results were so promising that in this year rail end welding was started on a scale that was large for that period when the art of rail end welding was still in its infancy, for in

Rail Ends Built up by Welding-Miles			
Year	Gas	Electric	Total
1926	168	—	168
1927	156	—	156
1928	188	4	192
1929	172	121	293
1930	82	—	82
1931	14	—	14
1932	48	—	48
1933	213	26	239
1934	245	94	339
1935	469	21	490
1936	597	257	854
Total	2352	523	2875
11-yr. average	214	47	261

1926 a total of 53,760 joints, representing 168 miles of track, were built up by welding.

So satisfactory were the results of this year's work in smoother riding track and in the prospective extension of the life of the rail that the practice has been continued on a large scale ever since, except during 1930, 1931 and 1932, when the amount of work was curtailed sharply, the aggregate mileage of these three years having been less than for any other single year since 1926. The accompanying table shows the miles of track upon which rail ends have been built up to and including 1936. The schedule for 1937 calls for 450 miles, of which 350 miles are to be built up with gas and 100 miles by electric welding.

Gas welding was employed exclusively in 1926 and 1927, but electric welding was tried out in 1928 and since that time has been used extensively, except during the three years 1930-1932, when the entire program was curtailed so sharply. During the entire period, the gas welding has been done by company forces under the supervision of the Oxweld Railroad Service Company, while the electric welding has been done under contract by Teleweld, Inc.

It became apparent almost at once that, valuable as the results were, the building up of the rail ends alone was not sufficient if the full benefit of the expenditure for doing so were to be realized. This led to the adoption of a number of other practices which are being followed with the same con-

sistency as the welding itself, for, in fact, they are considered by this company to be essential features of the welding requirements.

Joint-Bar Reinforcement

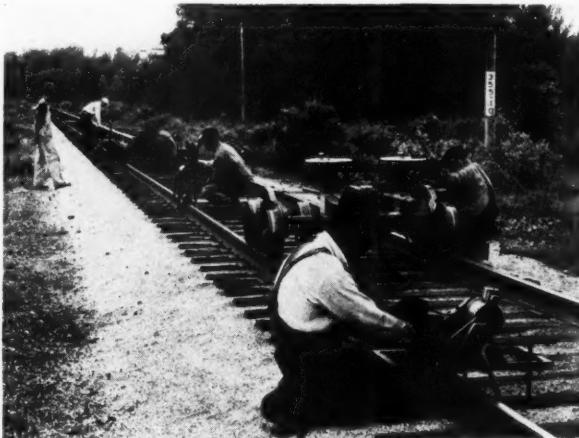
First and most important of these is compensation for the wear that invariably occurs on the fishing surfaces of the rail and joint bars, to insure a tight fit between the bars and the rail. On the Missouri Pacific this compensation is obtained either by the application of crowned bars or by the insertion of rail joint shims, although occasionally, new bars of normal section have been sufficient.

Prior to starting the welding forces on any district, a careful survey is made to determine the amount of wear on the fishing surfaces and the condition of the joints in other respects. From the information thus obtained the action to be taken is determined. The bars are classed as damaged and worn, the damaged bars being marked for renewal. If the bars are badly worn, the broken bars may be replaced with crowned bars; if little worn, good second-hand bars with joint shims may be used. Likewise, the worn joint bars may be replaced with reformed bars, or they may be reversed and have joint shims applied. In some cases the joint shims

ers became available they displaced the flatters, and have been used for smoothing the welded rail ends ever since. This was followed shortly by the practice of cross-grinding the rail ends to eliminate the probability of chipping, which so often results from metal overflowing the rail ends under the rolling action of the wheels.

Later, attention was directed to the desirability of hardening the ends of new rail by applying heat treatment in the field, to reduce the rate of joint batter, and after the benefits of doing this had been confirmed, this method of conservation was adopted as standard practice, and has since been applied to all new rail as laid. Recently, consideration has been given to the desirability of using either controlled-cooled or normalized rails and of having the ends hardened at the mill, in fact, all of the new rail laid in 1937 was controlled-cooled rail.

Shortly after the hardening of the rail ends became a practice, it was recognized that the full benefits could not be realized from it unless the adjacent rail ends stood at the same elevation. This led to the extension of surface grinding to include new rail to equalize the difference in height of adjacent rails, which results from mill-tolerance. The new rails are also cross-ground for the same reason that the welded rail ends are. Logically,



A Complete Electric Welding Operation From Pre-Heating to Cross Grinding

are applied without reversing the bars. In most instances in recent years it has been found sufficient to apply the shims without turning the bars the first time the rail ends are built up.

Rail-End Grinding

In the beginning, flatters were used to shape the added metal and to bring the adjacent rail ends to an even, smooth surface. This method was not altogether satisfactory because it lacked the precision which is now recognized as necessary for best results. Accordingly, as soon as surface grind-

the hardening of the ends of the new rail led to the same treatment for those that had been welded.

While the foregoing items must be classed as maintenance operations, except as they are applied to new rail, they do not properly belong to routine maintenance, since they need be done only at intervals of several years. Yet, it is generally recognized that routine maintenance also plays a considerable part in determining the life of rail. In the view of the officers of the Missouri Pacific, no item of routine maintenance has a more pronounced effect on the life of rail than

that of keeping bolts tight. Of equal importance, they believe that they should be maintained at a uniform tension.

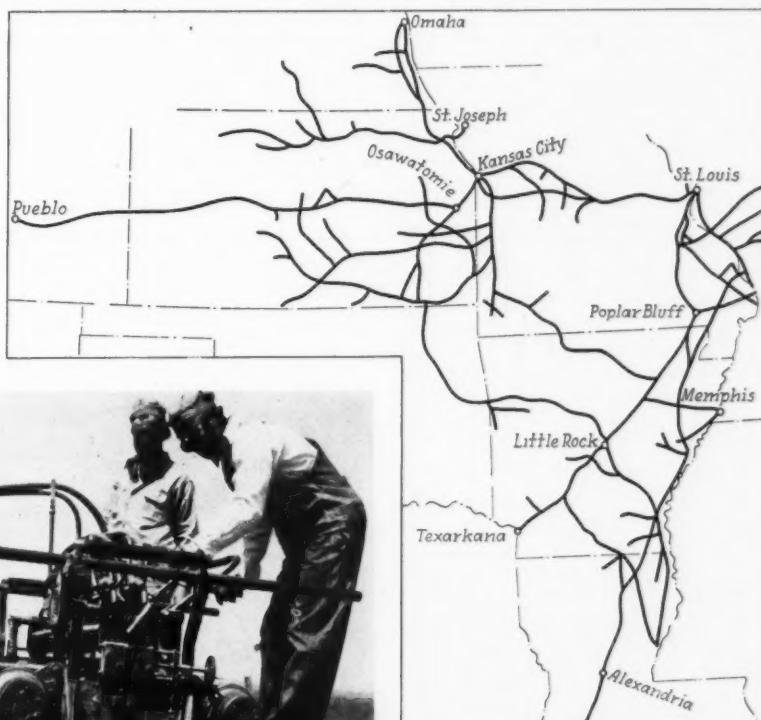
Experience having shown that no uniformity in bolt tension can be expected where the tightening is done manually by the local forces, bolting has been made a system operation. Accordingly, six bolting gangs, each equipped with two Nordberg bolt tighteners, one for each rail, are sent into the field about April 1 and are kept there until October 31, working out of face as they advance. These gangs are division gangs, however, each division providing the force to man the machines while they are on that division. One or more bolt tighteners, as needed, are also kept with the welding gangs, to insure the proper tightening of the new or adjusted joint fastenings in connection with the welding.

Careful investigation has been made to determine the desirable bolt

plates and the necessity for sufficient area to insure a substantial bearing on the tie, the Missouri Pacific also studied the relation of the tie plate to the life of rail.

It was already known that tie plates having insufficient area cut quickly into the ties, and that those that were fastened insecurely cause considerable abrasion to the wood fibre. The

being installed with all new rail as it is laid, the Missouri Pacific also has 11 miles of GEO track, including 0.4 miles only partially equipped with GEO fastenings. The rail in this GEO track was laid without expansion allowance at all temperatures higher than 40 deg., F., so that the joints do not stand open under a wide range of temperature, with the result



Right—Hardening Rail Ends by the Oxy-acetylene Process—Upper Right—Map of the Missouri Pacific



tension, and all of the bolting machines are set to kick out when this tension has been reached. In practice it has been found desirable to adjust the tripping mechanism daily, to insure minimum deviation from the standard tension.

Tie Plates Protect Rail

Tie plates constitute another type of device which was designed originally and has been used for a specific purpose not connected with the conservation of rail, but which does have a direct bearing on the life and performance of the rail. Designed to protect the tie against mechanical destruction, all roads have found it necessary to increase the thickness and area of the plates from time to time, as wheel loads, train speeds and traffic density have increased. While recognizing the primary purpose of tie

study disclosed what was also known in part, that in either event the settlement of the tie plate into the tie seldom occurred uniformly over its area, and that the inclination of the plates which resulted from this settlement likewise lacked uniformity, since it might be in or out, depending on a variety of conditions. It was also shown that this out-of-level condition of the tie plates resulted in uneven wear on the rail head. On the Missouri Pacific the size of the tie plates had been increased from time to time until single-shoulder plates 8 in. by 10 in. in area were being used with 110-lb. rail. Later this was increased to 8 in. by 11 in. for 112-lb. rail, and a second shoulder and means for fastening the plate to the tie independently of the rail fastening were added.

In addition to its normal track construction, in which larger tie plates fastened securely to the tie are now

that rail end batter has been almost eliminated, while the wear on the fishing surface is less than in the usual form of track construction.

Flange Lubricators

As a still further means of conserving its rail, the Missouri Pacific has placed in service a number of Meco rail and flange lubricators to reduce curve wear, and is extending the use of this device. The first of these were installed in 1935, between Kansas City, Mo., and Osawatomie, Kan., a line of heavy traffic and many curves, some of which range up to 6 deg. The rail on the curves upon which the first installations were made had lasted normally for 18 months or less. In the two years that these curve lubricators have been in service, the rail has worn so little that it is impossible at this time to estimate when it will be unfit for further service. In large part, this experience has been repeated at points where similar installations have been made between St. Louis, Mo., and Poplar

Bluff. In fact, the benefits that had been derived from these early installations were considered sufficient to warrant increasing the number in service in 1936, while 20 more were added this year.

Loss Due to Brine Drippings

It is well known that brine drippings from refrigerator cars cause a large annual loss through corrosion of rail and fastenings, bridges and signals, although the aggregate of this damage is seldom realized for it has been difficult to reduce it to concrete terms or to evaluate on it. However, the Track committee of the American Railway Engineering Association, reported in 1934, an annual loss of \$2,350,000 on 17,930 miles of main-line tracks concerning which it had been able to obtain information.

The Missouri Pacific handles a relatively heavy refrigerator traffic between Omaha, Neb., and St. Louis, Mo., and between St. Louis and Texarkana, Ark., and corrosion has presented a problem on these lines. Recently, however, the practice has been established of spraying a coat of heavy-asphalt-base oil on the rail and fastenings in the territory affected by brine drippings. Because it has been effective in reducing corrosion of the metal parts of the track almost to the point of elimination, this practice is looked upon definitely as a rail conservation measure.

Use of Sperry Car

Like other roads, the Missouri Pacific has been plagued with its share of transverse fissures, horizontal split heads and other interior defects of rail which do not become apparent visually until failure occurs. To fore-stall these failures, with their potentially disastrous consequences, for several years this road has used the Sperry detector service consistently. In fact, it keeps one of the latest models of the Sperry detector cars in continuous operation throughout the year, making trips at regular intervals over all primary and important secondary lines, and as often as practicable over those of less importance and lighter traffic.

It should not be assumed from the practices already referred to that the Missouri Pacific has reached the stage where its rail conservation has been placed on an ideal basis, for its officers make no such claim. They recognize that there are certain shortcomings in their present practices, and that they are omitting some things that would doubtless be of benefit. With full appreciation of these facts, they are endeavoring to eliminate the

shortcomings as rapidly as practicable, and as opportunity affords they are taking advantage of later developments to round out the conservation program.

One of the objectives toward which the officers of the Missouri Pacific are working is a stabilized program of rail end welding. By reference to the table it will be observed that an average of 261 miles of rail has been reconditioned annually in this manner since 1926, but that the fluctuations by years have been quite large. If the work to be completed in 1937 is added, the annual average will be 277 for the 12 years since 1926. It is estimated, however, that with the hardening and grinding of the ends of all new rail as it is laid, the welding schedule can be stabilized at 350 miles a year, and this is the objective that is now being sought.

Improvement in some of the practices must follow the normal processes of time. As an example, it is obvious that it is impracticable to ex-

tend the use of the present design of tie plate more rapidly than the requirements for new rail, since the use of tie plates is now general on all primary and important lines, and in large part on less important lines, since tie plates are being used with released rail as it is laid on these lines.

Co-ordination and Consistency

While the Missouri Pacific has not introduced any innovations with respect to the methods it is following in caring for its rail, the complete co-ordination of its practices to insure best results from the work that is being done, and the consistency with which all of its conservation work is being carried out are outstanding. The entire rail conservation program has been developed by A. A. Miller, engineer maintenance of way, and is being carried out by the division engineers under his direction and under the direct supervision of the respective district engineers.

Use Second-Hand Steel in Wood Trestles

Southern Pacific Lines in Texas and Louisiana use steel caps and in some cases also steel beams on wood pile bents

THE Southern Pacific Lines in Texas and Louisiana have developed a steel cap for four-ply packed chord trestles, that provides profitable use for second-hand 10-in. I-beams and affords a service test of the steel cap for comparison with the results obtained with the usual wood cap. The design also embodies means for attaching both the caps and the chords that overcome some of the disadvantages of the drift bolts ordinarily used for this purpose. In general, the new cap comprises an extension of the development embodied in a metal-sheathed wood cap brought out by this road a short time ago, and described in *Railway Engineering and Maintenance* for September, 1934.

The cap consists of two 10-in. 38.36-lb. I-beams, with $\frac{3}{8}$ -in. by 14-in. cover plates welded to the outer edges of the top and bottom flanges. These welds are not continuous but

are applied in stitches from 4 to 6 in. long for an aggregate length of about $4\frac{1}{2}$ ft. out of a total cap length of 12 ft. The caps are detailed for both five-pile and six-pile bents.

The chord connections are made by means of 6-in. by 4-in. angles 15 in. long (two for each chord) that are bolted to the cap through holes in the top cover plate, the beam flanges being notched to provide a square bearing for the bolt heads against the underside of the cover plate. The holes in the cap for the connection to the angles that bear against the inner sides of the chords are slotted to allow a variation of about three inches in the width of the packed chord.

Cap and Pile Connections

Two means of connecting the caps to the piles are afforded. One of these is a dowel $1\frac{1}{8}$ in. in diameter by 4 in. long, that is welded to the underside of the bottom cover plate at the axis of each pile location. These dowels fit into $1\frac{1}{4}$ -in. by 4-in. pipe sleeves set into holes drilled in the top of the piles. In addition, holes in the edges of the bottom cover plates, like those

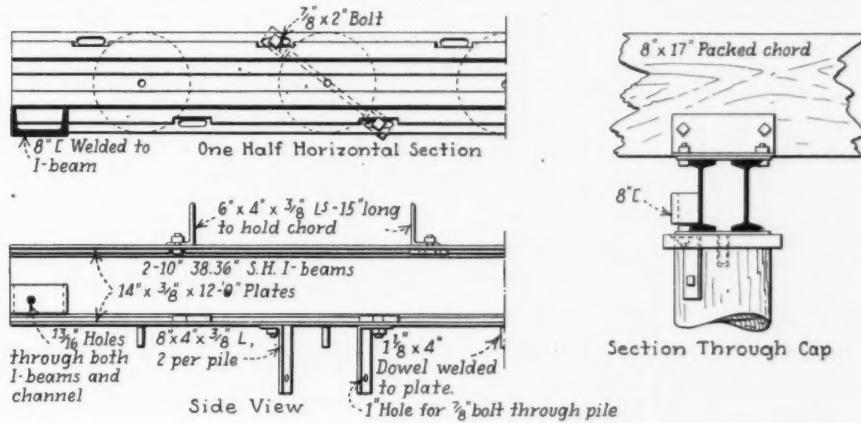
in the top cover plate, afford the means of attaching clip angles to the underside of the caps. These clips are applied with their short legs (4 in.) against the cap and their long legs (8 in.) projecting downward, and as the holes in the cover plate are slotted and

by means of 8-in. channels 4-in. long, welded to the end of the I-beam on one side and to the opposite end of the other beam on the other side, with the backs of the channels flush with the edges of the cover plate. This affords a flat bearing for the brace,

are tied together at the ends and mid span by diaphragms of plates and angles. Second hand 6-in. by 4-in. angles are used for lateral bracing as shown in the drawing.

The end spans differ from the intermediate spans in that, in place of

Details of the Steel Cap for Pile Trestles

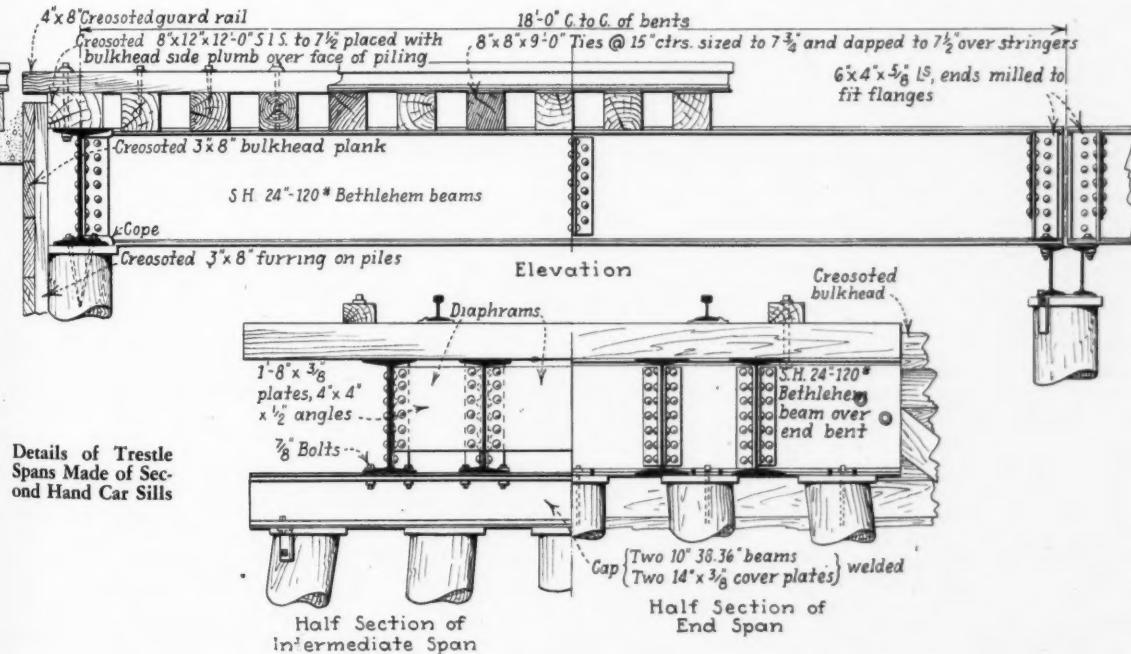


the clips can be pivoted on the bolts that connect them to the cap, sufficient play in the position of the clips is afforded to permit them to be brought to bearing against the piles in spite of considerable variation in diameter. A pair of clips is provided for each outside pile and the middle

which is attached by a 3/4-in. bolt that extends through the plank and through holes in the channel and both of the I-beams.

These steel caps have been used also in trestles embodying the use of steel beam decks in which remodeled center sills from scrapped freight

the double-beam cap, the end bent is capped with a 24-in. I-beam cut to a length of 12 ft. The pile cut-off is made at such an elevation that beams of the end span may be framed into the beam on the piles. As a result the latter functions not only as a bent cap but also as the end diaphragm for the



Details of Trestle Spans Made of Second Hand Car Sills

pile of a five-pile bent, and for the two outside and two inside piles of a six-pile bent. The clips are attached to the piles by means of 7/8 in. bolts in holes bored through the pile between the two clips.

Brace plank connections are made

cars have been used for stringers. These center sills, 24-in. 120-lb. Bethlehem beams, are cut to lengths that provide spans of 18 ft. center to center of bents, with a clearance of 1 in. over the caps. Two beams are used under each rail and the four beams

span and as the support for a creosoted timber bulkhead.

These new trestles were developed under the direction of R. W. Barnes, chief engineer of the Southern Pacific Lines in Texas and Louisiana, with headquarters at Houston, Tex.

Do Higher Speeds

This represents the result of a study made by a subcommittee of the Committee on Economics of Railway Labor of the American Railway Engineering Association, and comprises an abstract of the report on this subject presented before the convention in March. Elmer T. Howson, editor of Railway Engineering and Maintenance, was chairman of the subcommittee, and F. S. Schwinn, assistant chief engineer, Missouri Pacific, was chairman of the entire committee.

PASSENGER trains are being operated today at sustained speeds that would have been considered impossible as recently as five years ago. This has been done (1) with trains of similar type, (2) with trains of standard locomotives and cars and (3) with locomotives of modified design, including streamlining, and streamlined cars basically of standard construction, but lighter in weight, while one road is operating a high-speed electrified service. Coincident with these increases in the speed of passenger trains, there has been a corresponding increase in the speed of freight trains.

As a basis for comparing present labor costs for track maintenance with the costs under lower speeds, an investigation was made to ascertain how much speeds have been increased. This varies somewhat between roads and is influenced by differences in operating conditions on different sections of individual roads. However, existing passenger schedules have been shortened variously up to 25 per cent, while the newer trains are being operated on schedules that are as much as 30 to 40 per cent shorter than those of the previously fastest trains. Likewise, freight service has been speeded up almost universally, and not a few of these trains are now running at speeds from 50 to 100 per cent higher than formerly.

These higher speeds have brought about no fundamental change in the form of track construction, and there is little indication as yet that the pres-

ent design of track is inadequate for the maximum speeds at which the fastest trains are now being operated, although in some instances it has been found desirable to strengthen some of the details by applying ballast and filling out slack places in the ballast, by laying heavier rail and by lengthening turnouts.

General Refinement Required

Higher speeds call essentially for greater refinement in line and surface than can usually be justified for ordinary speeds. They also call for revisions in curve practices, that is, for adjustments in superelevation and the length of spirals and for greater uniformity in superelevation. For these reasons, prior to the inauguration of high-speed service, most roads find it necessary to do considerable preparatory work in the way of surfacing and lining tangents as well as curves. In the case of curves, this has generally been done in connection with the adjustment of spirals and superelevation. In some cases curves have been ballasted, tied and surfaced; in a few others, the work has also included the application of new and heavier rail, where the existing rail was curve worn. In the main, however, general applications of ballast have been deferred to follow the laying of rail in the general rail renewal program.

Higher speeds have made it essential to raise the standard of track maintenance with respect to line and surface, and this applies with particular emphasis to curves and their spirals, since relatively small defects which would be scarcely noticed at ordinary speeds may result in considerable discomfort to passengers as speeds are increased. Obviously, however, to maintain line and surface to a higher standard, other features of the track must be given equally close attention, including gage, level, joints, fastenings, ties, ballast, drainage, vegetation and roadbed. In other words, the demand for greater refinement in line and surface requires that more labor must be expended on every other

item of track and roadbed construction and maintenance, thus adding definitely to the labor requirements for track maintenance.

One of the serious obstacles to sustained high speed is the placing of slow orders by the maintenance forces. For this reason, it has become necessary on those roads having high-speed service to revise their methods of doing work to eliminate slow orders or to reduce them to the absolute minimum. Substantially all of these roads now make it imperative that section and bridge gangs do their work in such a way as to avoid the necessity for reducing speed or that they restore the track to condition for full speed before the passage of scheduled trains. Obviously, these requirements increase the amount of labor involved. To reduce this nonproductive time for large gangs engaged in laying rail, ballasting or general surfacing, it is customary to divert traffic to another track on multiple-track lines, and some roads are installing No. 16 temporary crossovers to avoid too much reduction in speed as trains are being diverted.

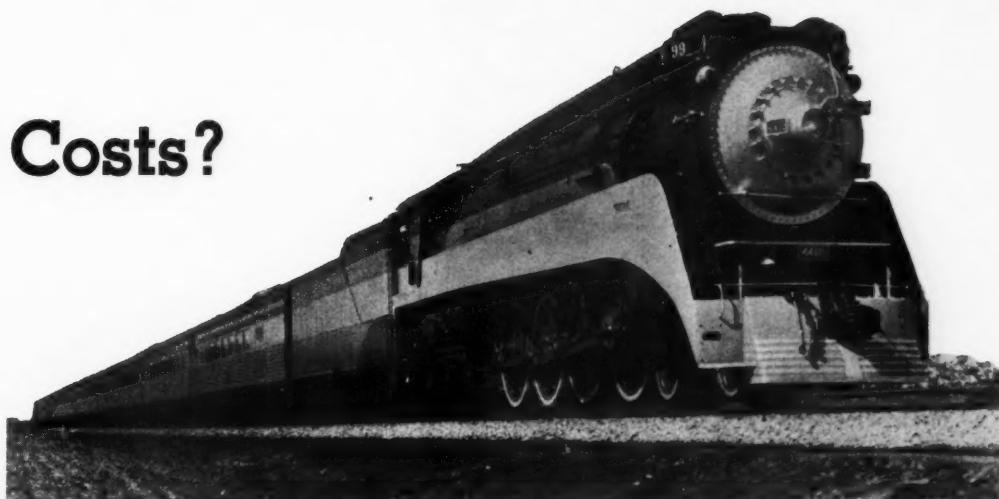
Effect of Speed on Track

It is generally recognized that higher speeds increase the piece-meal destruction of track which occurs constantly at all speeds. Particular attention was directed, therefore, to the effect of the higher speeds on the rate of this destruction and to whether any distinction can be made between the various types of equipment running at these higher speeds. Because of their lighter weight and absence of reciprocating parts, the Diesel powered trains are only slightly more destructive to track when running at maximum speed than when running at moderate speeds, and as compared with high-speed freight trains their effect is practically negligible.

Steam locomotives designed especially for high-speed passenger service, with well-distributed loads and proper counterbalancing, also have little damaging effect on track, cer-

Track Labor Costs?

The "Daylight" Streamliner of the Southern Pacific



tainly not more than standard passenger locomotives at ordinary speeds. When it comes to freight locomotives, however, the situation is different. Few locomotives in freight service today are designed for the speeds at which many of them are being operated. The result is that they knock the track out of line and, in extreme cases, bend the rail, thus adding materially to the labor requirements for maintenance. Even where passenger locomotives of the usual design are run at the higher speeds, their effect is noticeable immediately in increased labor for track maintenance.

Factors Decreasing Labor

The amount of labor required to maintain track under high-speed operation is affected by many factors, some of which tend to increase and others to decrease labor costs. By increasing the weight of rail, by bringing tie conditions to a higher standard, by applying ballast and installing double-shoulder tie plates, by putting in longer turnouts and by making similar improvements in track construction which tend to increase the strength of the track structure, the effect is to decrease the amount of routine maintenance and, therefore, the labor cost of maintenance. Likewise, the greater uniformity and consistency in curve elevation which is now necessary, the more nearly perfect alignment of curves which has been provided and the better spiraling practices which have been introduced have had a similar tendency.

As a further, though temporary, factor affecting the labor cost of

track maintenance, most roads that are operating high-speed trains did considerable preparatory work in advance of their initial runs. This involved an initial expenditure of considerable magnitude, which has been offset in part by a temporary reduction in routine maintenance until after the influence of the preparatory work was past.

On the other hand, the necessity for greater refinement in line and surface for the higher speeds obviously increases the amount of labor needed to maintain the higher standard of smooth riding. This is particularly true since line and surface are so closely inter-related with other items of track construction and maintenance. Furthermore, the amount of labor required to maintain line and surface is related directly to both the speeds that are maintained and the type of equipment which is used for the higher speed.

Because the many factors which tend to increase and to decrease the labor requirements are not uniform as between roads or on individual roads, they do not affect all roads alike. For this reason, the committee was unable to present a single conclusion, as to the effect of the higher speeds on the labor cost of track maintenance, which can be applied to all roads alike. In lieu thereof, it presented the following summary of its study.

Conclusions

1. Developments in the new field of higher speeds are making necessary higher standards and greater refinement in tracks, including greater uniformity in curve elevation.

2. An initial expenditure, varying in magnitude for individual roads, may be necessary to attain the higher standards demanded.

3. Diesel power units; steam locomotives designed for high speed, which have proper load distribution and counterbalancing; and light-weight passenger cars, when operated at high speeds, are no more destructive to track than the usual type of passenger locomotives and cars when operated at ordinary speeds. However, ordinary passenger locomotives and cars are more destructive when operated at high speeds than when operated at ordinary speeds.

Destructive to Track

4. At speeds higher than those for which they were designed, freight locomotives are highly destructive to track, while loaded freight cars moving on fast schedules also create considerable damage.

5. Higher standards and greater refinements in maintenance increase the labor cost of track maintenance, possibly as much as 10 per cent. No further increase is required where light-weight equipment and specially designed locomotives are operated but labor costs may be increased somewhat more than this amount where standard equipment is operated at high speed. Because of the greater damage created by freight equipment, labor costs for track maintenance may be increased by as much as 25 to 50 per cent, depending on the number of such trains, the speeds at which they are operated and the design of the locomotives used to pull them.



Above—Using the Paint Spray Under the Eaves. At Right—Burning off the Old Paint with Propane Gas and a Specially Designed Torch

Catching up



An interesting program of building repair and painting has been inaugurated by the receivers of the Wabash, the purpose being to improve the condition of as many buildings as possible before the end of the present working season. This article describes the manner in which the program is being carried out, the organization of the forces, an improved method for removing the old paint, the use of spray painting and how the work is being done with only the normal seasonal increase in the building force.

TO CATCH up on deferred building maintenance, the Wabash has undertaken a system-wide program of building repair and painting which calls for attention to most of its frame buildings during the present working season. While preferred attention is being given at this time to frame buildings, the program includes all types and classes of buildings. It is not expected, however, that all of the work that may be considered necessary on the larger buildings, including shops, enginehouses, etc., can be completed this year, for an essential feature of the program is that the work shall be done by the regular building forces with no more than

the usual seasonal increase in the number of men employed. The only exception is a small increase in the number of painters compared with the force employed on this work during the last eight years.

Repairs Were Deferred

During the period of the depression, the Wabash, in common with practically every other road in the country, curtailed sharply its appropriations for building maintenance and the painting of buildings. The result was that frame buildings particularly were beginning to present a rather unpleasing appearance. For this reason, a systematic inspection was made to determine what work would be necessary to restore these structures to first-class shape. This inspection disclosed that while many minor repairs would be required, particularly to doors, windows, base boards, skirting, etc., only a few cases were found where the buildings were suffering from serious or extensive depreciation because of lack of repairs. In practically every case these latter were buildings that had needed major repairs when the depression

made it necessary to defer the work which had been planned.

A number of cases of general failure of the roofing had occurred during the depression period and new roofing had been applied, in which event neither repairs nor renewal were required as a part of the program. In other cases, the roofing requirements range from minor repairs to complete renewal.

On a Division Basis

Although the program is being carried out on a system-wide scale, each division is handling its own work, no system gangs having been considered necessary to supplement the division forces. In general, the work is being done out of face, that is, a carpenter gang is started at one end of a division or district and completes all work as it advances. When it reaches a station or a terminal it makes the needed repairs on all frame buildings before it moves on to the next point. Where only minor repairs are needed, the foreman splits the gang up, assigning two or more men as required to each building or class of work. If the work is heavier, such as raising the

on Building Maintenance

building or renewing sills and floor joists, the entire gang is thus available to do the work.

A study of the use made of all roadway buildings has enabled the repair gangs to eliminate quite a number of the smaller buildings along with their regular work, thus reducing the amount of maintenance and painting required. In a number of cases where separate coal houses were maintained, they were dismantled and the material thus released was used for constructing coal bins inside of freight rooms.

On the frame buildings the repairs

ing, base boards, skirting, water-tables, thresholds, door and window frames, and gutters and downspouts. Many of the smaller buildings are supported on pile heads or timber posts which rest on blocking. In the majority of cases where this form of support is used the posts and blocking require renewal.

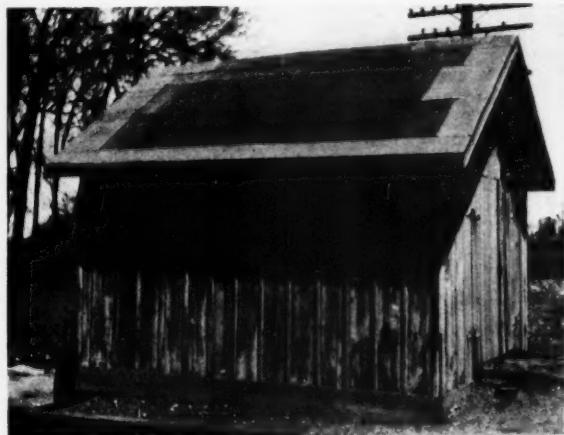
Outfit Cars Provided

Each gang is provided with an outfit which includes supply, tool and boarding cars. To avoid the necessity for carrying a large stock of mis-

cellaneous material on the supply cars, a bill of material is made up for each building, based on the inspection notes and it is sent to each station shortly in advance of the arrival of the gang. Obviously, however, in carrying out a program of complete repairs to every building, certain items will be found to need attention, which were not apparent when making the inspection.

To avoid delays to the work, the gangs are required to keep a stock of staple sizes of building lumber on the supply cars, from which they are able to draw in the event that unforeseen items are disclosed while the repairs are under way. Any material thus used is replenished immediately to avoid possible delays later. A stock of hardware, including nails, screws, bolts, door and window fittings, etc., is carried in the supply cars. Such items as needed are not shipped with the remainder of the bill of material, but are sent directly to the gang for incorporation in its regular stock.

In general, the program requires that the carpenter gang shall keep two stations in advance of the paint gang to insure that the latter will not be delayed waiting on the repair work. In practice this has worked out quite satisfactorily, because, while the paint gang may gain on the carpenter gang when the latter reaches one of the larger stations where a number of



At Left—A Section Tool House Repaired and Ready for Painting. Below—Applying the Paint with a Paint Sprayer

are of the type usually handled by house carpenters and, obviously, a relatively small gang is more effective on such work than a larger one. For this reason, the gangs engaged on the program average about six men, exclusive of the foreman, with none containing more than eight. When work is started on any building, all necessary repairs are made from foundation to roof, both outside and inside the structure. This program includes the seating facilities in waiting rooms; all shelving and cupboards in offices; the doors and windows, including glazing and hardware; and chimneys.

In addition to those mentioned, the repairs include the replacement of sills, floor joists, floors, weatherboard-



buildings must be given attention, it is quite likely to fall behind in doing its own work at this point.

Paint gangs consist of a foreman and 10 men, 8 of whom are engaged continuously in painting buildings, while 2 are assigned regularly to painting roadway signs and switch targets. In those instances where the latter catch up with the building group they stop and assist with the buildings, until the gang is ready to move



Windows Are Protected by Heavy Paper

forward. This keeps the gang together and makes it easier for the foreman to supervise the painting of the signs and switch targets.

Studies were made of the cost of painting to the former standards which called for a large amount of hand work in painting trim. The amount of trim was reduced to the minimum required to produce a pleasing result and this called for slight changes in the color combinations.

Before any paint is applied, all of the badly deteriorated old paint is burned off. Where the old paint is in good condition the surface is scraped and is gone over with wire brushes. Inspection of the paint on old station buildings has shown that the expense of removing all coats down to bare wood is justified. On a number of stations which had not been painted for 12 years, those which had been burned prior to last paintings are still in good condition and can be repainted with only minor repairs and a light cleaning. Those which were not burned not only require complete burning now, but the repair work is much heavier because of the failure of the old coats to protect the wood. In some cases the old paint burned

off was $\frac{1}{8}$ in. thick but so badly cracked and checked that it allowed the water to get through to the wood.

Propane, a gaseous hydrocarbon found in crude petroleum, compressed in cylinders, is being used to burn off the old paint. It is used at a cylinder pressure of about 30 lb., and the flame is applied to the paint through a gas burner designed on the principle of the bunsen burner, which can be regulated to give a concentration or spread of the flame as desired.

It has been the experience of the Wabash forces that the flame from this gas is hotter than that from a gasoline blow torch, the usual means of burning off old paint. As a result, the paint comes off more easily, leaving a cleaner surface with less effort, and a larger area can be cleaned in a given time. It is not necessary to keep the flame going continuously, since it can be shut off at any time when not in actual use and can be lighted again with a flint and steel which form an

cluding a gas driven compressor, a paint tank and two spray guns. Two coats are applied to the entire building in this manner. Colors for the exterior are stone and Tuscan red. On the interior the paint is light buff, with a dado of Tuscan red, with window and door trim of the same color.

Several brands of ready-mixed paints are being used, but to avoid the possibility of minor differences in color which are sometimes found in the paints mixed to the same color card by different manufacturers, only one brand is used on any building or on the buildings at any station. After the last coat is applied, the date of application, brand, and the number of coats are stenciled in an inconspicuous place on each building. A record containing this information and the quantity of paint used is also being kept for every building on the system so that a determination can be made of the suitability and dependability of the different brands that are



Stations Present a Pleasing Appearance After They Are Repaired and Painted

integral part of the burner. In marked contrast to the blow torch, the heat is applied under low pressure as an open flame which obtains its oxygen from the atmosphere, no oxygen tank or mixer being required, thus almost entirely eliminating fire hazard. On the average, one cylinder of propane is sufficient to care for four to six buildings, although this may vary somewhat in individual cases.

While two men are engaged in burning off the old paint, the other members of the gang cover the windows with heavy paper to prevent paint from getting on the glass and sash. As soon as this is done they go over the surfaces which are not to be burned, to remove loose and chalked paint with scrapers and brushes.

When a sufficient area has been cleaned the painting is started, the application being made by means of a De Vilbiss spray painting outfit, in-

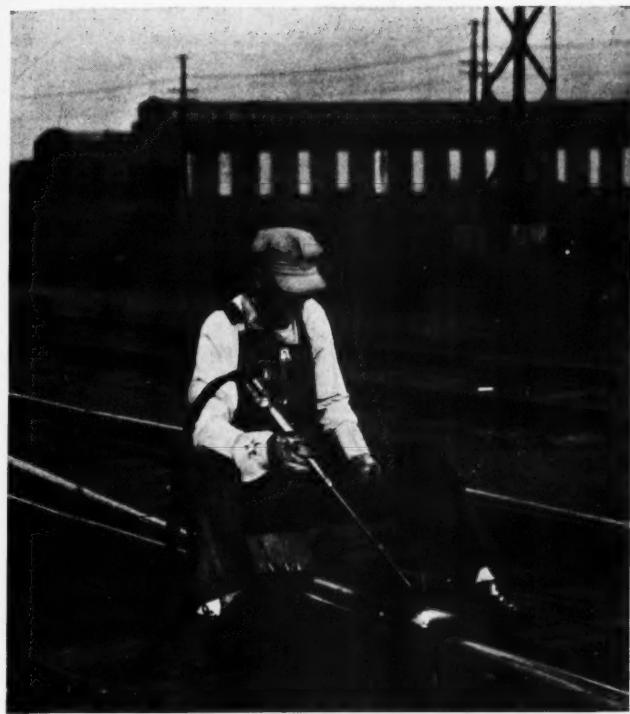
cluding a gas driven compressor, a paint tank and two spray guns. Two coats are applied to the entire building in this manner. Colors for the exterior are stone and Tuscan red. On the interior the paint is light buff, with a dado of Tuscan red, with window and door trim of the same color.

Several brands of ready-mixed paints are being used, but to avoid the possibility of minor differences in color which are sometimes found in the paints mixed to the same color card by different manufacturers, only one brand is used on any building or on the buildings at any station. After the last coat is applied, the date of application, brand, and the number of coats are stenciled in an inconspicuous place on each building. A record containing this information and the quantity of paint used is also being kept for every building on the system so that a determination can be made of the suitability and dependability of the different brands that are

being applied. A separate report is kept for each structure to serve as a record of cost.

While the program contemplates the eventual repair of all the buildings on the system, at present attention is being directed more particularly to stations, company dwellings, section tool houses, pump houses, coal and other outhouses, interlocking towers, crossing and switchmen's shanties, and other miscellaneous roadway buildings. To improve further the appearance of its property, the railway is asking industries that have buildings on the right of way to paint them the same color as its own buildings.

The program has been developed under the direction of J. C. Bousfield, chief engineer, and is being carried out by the division engineers under the direction of W. E. Gardner, principal assistant engineer.



Welding a Frog on the Burlington

While both open-hearth and manganese frogs and crossings may now be welded with a high degree of success, there was a time when such work—particularly the welding of manganese trackwork—was attended with considerable uncertainty as to results. In this article Mr. Tracy tells how the Burlington attacked the problem, describes the practices on his road and explains why he favors the welding of frogs and crossings in track.

By S. E. TRACY

Track Welding Supervisor,
Chicago, Burlington & Quincy

Welding Special Trackwork— How the Burlington Does It*

YEARS ago, with the advent of heavier motive power, it became evident that one of the most important improvements that could be made in the upkeep of tracks was in the maintenance of frogs and crossings. It was not long before welding loomed as a possibility in bringing about the necessary improvement but its application was hindered by the fact that the welding processes were in their infancy and advances in metallurgy had been limited.

As a consequence there was a demand for research in this field, which was fulfilled by service and supply organizations in co-operation with the railroads. Today, as a result of the combined efforts of the two groups, thoroughly dependable welded structures are now produced which are not only capable of supporting the heavier

equipment but withstand equally well the additional loads imposed by present-day high-speed ultra-modern trains. Prior to the improvement which has been made in the welding processes it was not easy to convince a roadmaster that he should have a welder on his territory to take care of the frogs and crossings. Today it is impossible to convince the same roadmaster that he should not have a welder for this type of work.

Many important welding and cutting operations are now being performed successfully on every railroad, although the practices, methods, equipment and materials used are subject to considerable variations as between different railroads. For instance, on the Burlington we have conditions that are peculiar to our lines and so do other railroads; therefore our methods and practices may or may not be applicable to conditions on other lines. But we have had

sufficiently satisfactory results with our practices over a considerable period of time to justify certain definite conclusions.

Practices on the Burlington

Our standard practices include the exclusive use of the oxy-acetylene process in the welding of open-hearth frogs and crossings, and the exclusive use of the electric process in the welding of manganese frogs and crossing sections. We weld most of these parts in track under traffic rather than in a centralized shop.

We use the oxy-acetylene process in the welding of open-hearth frogs and crossings not because it is impossible to weld this material with the electric process, but because we have found, through experience and from observations on other railroads, that the former is less harmful in its effect upon the parent metal; there is

*Abstract of a paper presented before a joint meeting of the Maintenance of Way Club of Chicago and the Chicago Section, American Welding Society.

less chipping, cracking, or breaking of the welded parts; the welding equipment is of such a character as to be more easily moved around in yards and between locations; the investment in equipment is considerably less; and in the end the process is more economical.

Today we have in operation ten outfits for welding open-hearth frogs and crossings, each of which consists of a welder and a laborer. These outfits, most of which are equipped with bunk cars and tool cars, are stationed in the largest yard in their respective territories; although in certain districts, where there are many small yards, the outfits move about so frequently that they have no regular headquarters.

In either case the units, under the direction of the district engineer maintenance of way, are transferred from one location to another as often as may be necessary to keep all frogs and crossings in good condition. When the welder is moved to any yard, unless he has been sent there as an emergency move to correct some special condition, the understanding is that he is to build up all of the frogs in that yard that are in need of welding.

When to Weld

That brings up an apparently simple question—How does the welder know or determine that a certain frog is in need of welding? Before the welder can make an intelligent decision on this matter, he must have the answers to these pertinent questions: Has the frog been welded before? How long has it been in service in its present location? What is the general condition of the running rails, the bolts, and the filler blocks? What kind of traffic passes over the frog and at what speed? How many frogs are there in the vicinity that are in a comparable condition? What is the accessibility of the location?

The answers to these questions, of course, will vary with the location, but collectively they are the gage by which we determine if a particular frog is to be welded. This practice results in better maintenance of our frogs in general, and, therefore, we do not specify a definite minimum wear for every condition. If it were expedient to do so, we would establish the minimum wear at approximately $\frac{1}{16}$ in. That figure would represent the distance between a straight-edge and the inside edge of the wing rail, with the straight-edge being placed across the frog from one wing rail to the other in the vicinity of the thin end of the frog point. Each of our welders is supplied with a standard practice book

which he is required to follow in principle.

We are convinced that it is better to reclaim a frog when the wear is still in the early stages than it is to allow it to remain in track until the wear reaches the maximum allowable amount. When this practice is followed there is less trouble with warpage from welding or with surface bending under traffic; it is easier to keep the bolts tightened; the bolt holes in the frog point will not become enlarged, nor will the bolts become bent as quickly; and the filler blocks will serve their purpose better in holding the point rails and the wing rails in their true relative positions as to height and flangeway clearance.

When the bolts become bent and the filler blocks become worn to such an extent that the frog point has sagged and worn more than $\frac{1}{16}$ in. below the wing rails at the first point of wheel transfer from the frog point to the wing rails, the cost of welding the frog is increased, and the riding qualities of the frog are affected in proportion to the amount of sag.

Amount of Metal Applied

At one time it was our practice to apply enough metal on every frog point, regardless of the depth of the sag plus the wear, to bring it up to its original height, that is, level with the wing rail at the point of wheel transfer. Our present practice, however, is to apply only such metal as may be necessary to raise the top surface of the frog point to a level not more than $\frac{1}{16}$ in. below the top surface of the wing rails at the first point of wheel transfer.

There is so much variation in the car wheels that pass over any frog that it is quite impossible to set up a condition that will provide a smooth transfer for all of them at the same place. This fact had much to do with our change in practice, and we have obtained better results since the change was made.

It is our thought that the details of our welding procedure on open hearth frogs and crossings would not be of general interest, so I will therefore proceed to a discussion of our experiences and conclusions on the welding of manganese frogs and crossings. All special trackwork of this type is welded by the electric process.

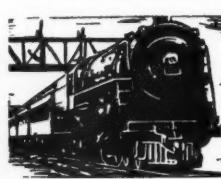
We have been welding both solid and rail-bound manganese frogs and crossings for about 11 years. During the early part of this period the results were very discouraging, but intermingled with the numerous failures were enough encouraging results to indicate possible success. In our attempts to improve on the results obtained, we tried every conceivable way of performing the work. To clean the surface of the parent metal before welding we tried the carbon arc, the oxy-acetylene cutting torch, and the grinder, and a combination of the three. We also used a grinder and a sand blast or both. We tried pouring water on the deposited metal before and after peening it. We kept water in the flangeways; used air hammers and different weights of hand hammers to peen the metal; deposited the metal in long, short, wide and narrow beads or in beads extending crosswise and longitudinally; and we tried pre-heating the parent metal to various temperatures. About the only thing that we did not try was the welding of a manganese section that was not ready for the scrap pile. Our results then would not justify the welding of frogs that today constitute routine jobs.

If, in the end, we were successful in getting a likely-looking frog by any of the combinations of methods, we placed a serial number on it and kept a book record of the methods that were used in performing the work. The frog was placed in track at a picked location, and inspections were made from time to time; or it was returned to us as a failure. From our records we were able to determine the combinations of methods that were giving the best results.

Procedure Adopted

From the data thus accumulated we found that the frogs on which the most simple combinations of methods had been used gave results as satisfactory as those on which any of the other combinations of methods were used. On the basis of these results the following method of procedure was selected: The loose or laminated metal is removed by the use of an oxy-acetylene cutting torch and/or a grinder; the new metal is then deposited in thin, narrow beads longitudinally with the worn section; the deposited metal is peened with a hand hammer after the placing of each one-half electrode; where practicable, the metal on the worn surfaces is deposited intermittently; and, in finishing, the sharp edges of the wing and point sections are rounded off.

In 1929, we purchased a portable electric welding unit in order that the



work might be done in track. Most of the frogs that were welded in track were not so badly worn as those which had been welded in the shop, and it was found that the results were better, although similar methods were used in doing the work. Following the adoption of the new method of procedure there were some failures, and there are failures today, but there is this difference; the former failures occurred after a comparatively short period of time while today, if they occur at all, it is only after several months service. It is believed that the use of a nickel-content manganese welding rod is responsible for this difference.

We find that many of the solid manganese frogs and crossings develop cracks somewhere in the section, generally after they have been in service for some time. In many cases the cracks are not of a progressive nature, but when present in certain locations in the castings they have a tendency to spread to such an extent that repairs become necessary.

We have attempted to repair these cracked sections by V-ing the sections adjacent to the crack and then welding, but the results were not satisfactory. During the last several months we have been making repairs to cracked sections by laying nickel manganese bars of various thicknesses across the crack and welding them to the outer surface of the section. To date, this method of repair has given satisfactory results. Most of this manganese work is now done in track, but we have a shop to which any emergency job may be sent if our portable track welding unit is not immediately available.

We have two locations on the railroad where open-hearth frogs and crossings are repaired. The materials removed from track at out-lying points, and those removed in connection with track changes or replacements, are sent to these locations for repair. The repaired materials are placed in stock for future use.

Shop Versus Track Welding

Many of the frogs that are repaired in track or on the ground in the immediate vicinity are made suitable for several years satisfactory service in an economical manner because the conditions to which the frog is to be subjected in service are known. On the other hand a frog that is sent to a centralized shop for repairs must be in such condition after it has been welded that it will be suitable for service in any location, because the exact conditions under which which the frog is to be installed are not known

Railway Engineering and Maintenance

at the time the work is carried out.

The welder in a centralized shop generally does not have occasion to inspect the frogs that he has welded after they have been placed in service. If he does inspect them he probably does not know how long the frog has been in track, or when the repair work was done. On the other hand, the welder in a yard or in an assigned territory has an opportunity to inspect his work quite frequently. In so doing he is aided by the fact that our welded frogs are marked with the welders identification number and with the date if welded in track. From these inspections the welder can determine if there are any defects in his methods which need correction.

This has been found to be particularly true in regard to the welding of manganese frogs and crossings. When the work is done in track the operator can and does watch the effect of traffic

upon the completed frog with a view to the correction of errors that he has made in finishing the work.

It is realized that there are certain advantages in the welding of frogs in a centralized shop. For instance there are usually better facilities for handling the frogs; the welder is not delayed because of traffic or weather conditions; and it is more practicable to use an acetylene generator. These things perhaps result in a reduction in welding costs, but when we took into consideration the investment in the necessary emergency or replacement frogs; the cost of removing, replacing, shipping and inspecting the frogs removed from track; and the cost of welding the rail ends or replacing the rail in track so that it will match the rail on the replacement frog, we concluded that greater savings in maintenance could be effected by following the methods which have been outlined.

Wood Preservation Gains Further in 1936

DURING 1936 a total of 222,463,994 cu. ft. of wood was given preservative treatment in the United States, an increase of 43,025,024 cu. ft., or 24 per cent, as compared with the quantity treated in 1935, according to figures compiled by R. K. Helphenstine, Jr., Forest Service, United States Department of Agriculture, in co-operation with the American Wood-Preservers' Association. While the amount of timber that was subjected to preservative treatment in 1936 was only 62 per cent of that treated during the peak year of 1929, it has been exceeded during only 9 of the 28 consecutive years that these figures have been compiled.

All of the eight classes of material treated showed increases last year as compared with 1935. The largest increase, both quantitatively and relatively, was shown in the quantity of poles treated, the gain in this classification being 19,105,645 cu. ft. or 53 per cent. With a gain of 10,346,946 cu. ft., or 10 per cent, crossties

showed the second largest increase. Other classifications showing substantial increases were construction timbers, with a gain of 4,747,665 cu. ft., or 30 per cent; piles, with an increase of 4,355,826 cu. ft., or 51 per cent; and miscellaneous, with a gain of 2,818,981 cu. ft., or 45 per cent.

As in previous years, the railroad industry maintained its position in 1936 as the principal consumer of treated timber. Thus the volume of crossties treated alone constituted 51.2 per cent of the total amount of timber treated, while crossties and switch ties combined made up 55.1 per cent of the total. These figures by no means represent the total proportion of all treated timber that is consumed by the railroads as they also use varying quantities of all the other classifications.

37,952,129 Crossties Treated

A total of 37,952,129 crossties were given preservative treatment last year. As was the case in 1935, oak ties ranked first in number treated, with a total of 16,293,294, or nearly 43 per cent of the total, southern pine being second with 8,729,659 ties, or 23 per cent, and Douglas fir third with 4,141,184 ties, or nearly 11 per cent.



Other woods represented were lodgepole pine, gum, maple, ponderosa pine, birch, tamarack, beech, hemlock and elm in the order named. All other woods accounted for only 586,777 ties or 1.55 per cent of the total.

Of the total number of crossties

Railway Engineering and Maintenance

1936 totaled 19,119,278 lin. ft., which represented an increase of 6,440,671 lin. ft., or 51 per cent as compared with 1935. More than 80 per cent (15,357,926 lin. ft.) of the piling treated last year was of southern pine, while Douglas fir ranked second with

(4,127,886 lb.) remained at substantially the same level that has prevailed during the last four years, being only 47,000 lb., or one per cent, greater than the 1935 consumption. The importance of this slight increase is further lessened when it is considered that the 1936 figure includes both zinc chloride and chromated zinc chloride.

Petroleum Consumption

The wood preserving industry also consumed 22,624,318 gal. of petroleum in 1936, which represents an increase of 3,418,999 gal., or nearly 18 per cent, as compared with the previous year. In fact, the consumption of petroleum for timber-treating purposes was greater last year than for any year since 1930 and has been exceeded in only four of the 13 years during which statistics on its use have been compiled. The consumption of miscellaneous salts increased from 966,825 lb. in 1935 to 1,804,976 lb. in 1936; while the use of miscellaneous liquid preservatives jumped from 2,741 gal. to 4,485 gal.

In 1936 there were in existence in the United States 217 wood preserving plants, an increase of three as compared with the previous year. Of this number 200 were in active operation and 17 were idle. During the

Crossties (Number) Treated by Kinds of Wood and Kinds of Preservatives—1936					
Kind of Wood	Treated with creosote ¹	Treated with creosote-petroleum ²	Treated with zinc chloride ³	Treated with miscellaneous preservatives	Total
Oak	12,850,720	3,368,324	56,291	17,959	16,293,294
Southern Pine	6,757,402	1,969,262	250	2,745	8,729,659
Douglas Fir	65,864	3,881,415	161,287	32,618	4,141,184
Lodgepole Pine	94,027	1,425,696	275,438	—	1,795,161
Gum	955,105	394,153	—	—	1,349,258
Maple	62,800	945,416	164,407	—	1,172,623
Ponderosa Pine	221,376	783,824	14,128	—	1,021,328
Birch	82,939	863,794	55,000	—	1,001,733
Tamarack	—	413,538	346,251	182,847	942,636
Beech	158,836	376,500	53,278	—	588,614
Hemlock	10,000	140,677	93,685	—	244,362
Elm	19,500	66,000	—	—	85,500
All Other	298,731	218,046	—	—	586,777
Total	21,577,300	14,848,645	1,220,015	306,169	37,952,129
Per cent of Total	56.85	39.13	3.21	.81	100.00

¹Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution.

²Includes distillate coal-tar creosote, creosote coal-tar solution, refined water-gas tar and water-gas tar solution in mixture with petroleum.

³Includes chromated zinc chloride.

treated in 1936, 21,577,300, or nearly 57 per cent, were treated with creosote, 14,848,645, or 39 per cent, were treated with creosote-petroleum mixtures, 1,220,015, or slightly more than 3 per cent, were subjected to zinc chloride treatment and 306,169, or less than 1 per cent, were treated with miscellaneous preservatives. These proportions reveal no important deviations from the previous year except that they reflect the increasing popularity of creosote-petroleum mixtures, the percentage of ties treated by such mixtures having increased from 35.5 in 1935. Of the total number of crossties treated in 1936, 24,367,161 were adzed and bored before treatment, 1,229,228 were adzed but not bored, 1,458,659 were bored but not adzed, and 10,897,081 were neither bored nor adzed. Practically all of the crossties treated in 1936 were subjected to the pressure process.

The quantity of switch ties given preservative treatment in 1936 amounted to 103,229,321 ft. b.m., which represented a gain of 9,191,462 ft. b.m., or 9.8 per cent, as compared with 1935. Here also oak was in first place with respect to the volume treated, with a total of 63,816,410 ft. b.m., or nearly 62 per cent of the total treated. However, as compared with crossties, the position of Douglas fir and Southern pine were reversed, the former being second with 13,807,565 ft. b.m., or slightly more than 13 per cent, and the latter third with 8,900,203 ft. b.m., or nearly 9 per cent. Maple accounted for 8,022,337 ft. b.m., or nearly 8 per cent of the total quantity of switch ties treated, and gum for 4,482,199 ft. b.m., or slightly more than 4 per cent.

The amount of piling treated in

3,313,562 lin. ft., or about 16 per cent of the total. The balance of 447,612 lin. ft. of piles treated consisted of Norway pine, lodgepole pine, oak and cypress. All piles treated were subjected to pressure processes and all but 720,612 lin. ft. were treated with creosote.

During 1936 the wood-preserving industry consumed 154,712,999 gal.

Wood Preservation, 1909-1935 Together with consumption of creosote and zinc chloride

Year	Total material treated cu. ft.	Number of crossties treated	Creosote used, gal.	Zinc chloride used, lb.
1909	75,946,419	20,693,012	31,426,212	16,215,107
1910	100,074,144	26,155,677	63,266,271	16,802,532
1911	111,524,563	28,394,140	73,027,335	16,359,797
1912	125,931,056	32,394,336	83,666,490	20,751,711
1913	153,613,888	40,260,416	108,378,359	26,466,803
1914	159,582,639	43,846,987	79,334,606	27,212,259
1915	140,858,963	37,085,585	80,859,442	33,269,604
1916	150,522,982	37,469,368	90,404,749	26,746,577
1917	137,338,586	33,459,470	75,541,737	26,444,689
1918	122,612,890	30,609,209	52,776,386	31,101,111
1919	146,060,994	37,567,247	65,556,247	43,485,134
1920	173,309,505	44,987,532	68,757,508	49,717,929
1921	201,643,228	55,383,515	76,513,279	51,375,360
1922	166,620,347	41,316,474	86,321,389	29,868,639
1923	224,375,468	53,610,175	127,417,305	28,830,817
1924	268,583,235	62,632,710	157,305,358	33,208,675
1925	274,474,538	62,563,911	167,642,790	26,378,658
1926	289,322,079	62,654,538	185,733,180	24,777,020
1927	345,685,804	74,231,840	219,778,430	22,162,718
1928	335,920,379	70,114,405	220,478,409	23,524,340
1929	362,009,047	71,023,103	226,374,227	19,848,813
1930	332,318,577	63,267,107	213,904,421	13,921,894
1931	233,334,302	48,611,164	155,437,247	10,323,443
1932	157,418,589	35,045,483	105,671,264	7,669,126
1933	125,955,828	22,696,565	85,180,709	4,991,792
1934	155,105,723	28,459,587	119,049,604	3,222,721
1935	179,438,970	34,503,147	124,747,743	4,080,887
1936	222,463,994	37,952,129	154,712,999	4,127,886

of creosote, an increase of nearly 30,000,000 gal., or 24 per cent, as compared with 1936. While the consumption of creosote in 1936 was higher than for any year since 1931 it was still nearly 72,000,000 gal. less than the 226,374,227 gal. that were consumed in 1929, the peak year. Because of the greater demand for creosote the amount imported (30,256,107 gal.) was substantially greater than imports in 1935.

The consumption of zinc chloride

year five new plants were built, of which two were plants of the pressure type and three were non-pressure (open-tank) plants. Three plants were abandoned during the year, including one non-pressure and two pressure plants. Of the total plants in existence 163 were commercial plants, which treat wood for sale or by contract, 24 were owned or operated for railroads and 30 belonged to public utilities, mining companies, or the federal government.

stan-
tailed
only
eater
the im-
furn-
dered
zinc
bride.

What's the Answer?



How Heavy Must Tie Renewals Be?

How heavy must tie renewals be to warrant a general raise in connection with their renewal? How is this determined?

No Relation Exists

By H. S. CLARKE

Engineer Maintenance of Way, Delaware & Hudson, Albany, N. Y.

In the ordinary upkeep of well-maintained track there is no relation between tie renewals and track raising, because the number of renewals is generally much below the number which would make it economical to raise track solely to accommodate the tie installation.

Where a large percentage of the ties are to be renewed, it is only natural that the ballast has been affected by the poor ties and the action of trains over the poor ties. In these events the advisability of raising the track and inserting the ties should be determined only through a careful inspection of the track in question. Generally speaking, a 25 per cent renewal is the approximate minimum for which track should be raised because of renewals.

Timber not a Factor

By J. MORGAN

Retired Supervisor, Central of Georgia, Leeds, Ala.

My observation is that tie conditions do not of themselves constitute a factor in determining whether a general raise is justified. Properly, tie renewals should be carried out year by year so consistently that even under adverse conditions, renewals should never aggregate more than 400 to the mile annually. Through the use of treated timber our renewals have decreased until they now average about 220 to the mile. Our tie material is generally second-growth short-leaf southern yellow pine, which can be expected to have a service life

of about 17 years, for which reason we have about reached a stabilized annual tie program.

Conditions warranting a general raise in track include uneven settlement of the track as a result of unstable roadbed, surfacing new rail, the need for straightening and spacing ties, center-bound track, dirty ballast and the need for a deeper ballast section. In general, where rail is to be renewed, we do not make normal tie renewals for a year or two in advance of the renewal of the rail, since considerable of the cost of inserting the ties can be saved by this practice, compared to digging in. If 25 per cent or more of the ties need renewal, a general raise is justified for this reason alone, but such a timber condition is the exception rather than the rule.

Several Considerations

By W. H. SPARKS

General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

So many factors must be given consideration in reaching a decision to raise track that it is difficult to segregate the ties and say that when renewals reach a certain point a general raise must be made for this reason alone. On the other hand, when renewals are heavy it is quite likely that some or all of the other factors are present and that the raise can be jus-

tified on the basis of the needs that are thus presented in combination. It can usually be taken for granted that on well-maintained track, tie renewals will rarely reach the point where the raise can be justified on the grounds of the tie renewals alone.

In reaching a decision as to whether the track should be raised, one must study (1) traffic conditions, that is, speed, volume and character; (2) the size of the rail, its ability to withstand wheel loads and its condition; (3) the kind and condition of the ballast; (4)

To Be Answered in October

1. At what intervals should motor-car setoffs be provided on single track? On multiple tracks? Should they be placed on the inside or outside of curves?

2. What are the advantages and disadvantages of welding as compared with riveting, in making repairs to steel bridges?

3. What do most ties fail under the rail? What can be done to eliminate or reduce these failures?

4. What material is most satisfactory for filling shallow cracks or uneven places in plaster walls? How should it be applied?

5. When laying new rail on double-shoulder tie plates, what precautions should be observed? Is it desirable that one shoulder be brought to a bearing against the base of the rail? If so, which?

6. How can expansion and contraction best be taken care of when installing long runs of hot-water and steam lines?

7. Where header rails are used through highway crossings, how should they be fastened?

8. What causes the crawling or creeping of paint? How can it be prevented?

the depth of the ballast; (5) the character and condition of the roadbed, and whether it is drained adequately; (6) how long since the track was last given a general raise; and (7) how many ties need renewal.

If the ballast is foul or is of insufficient depth or if the track has not been given a general raise for several years, it is likely that maintenance is costing too much or that the track is rough and center-bound. In any of these cases a general surface is called for regardless of the number of ties to be renewed, but renewals can be made at less cost as the track is lifted in connection with the raise.

Other Factors Determine

By A. CHINN
Chief Engineer, Alton, Chicago

Track is seldom raised for the sole purpose of accommodating tie renewals. Usually other conditions must be considered, and the final decision will be based on all of the factors involved. For instance the ballast section may be too light, the ballast may be foul

or the track center-bound. In any of these events the track will need a general raise, irrespective of tie renewals, but the best time to renew the ties is while the raise is being made. If tie renewals are heavy, track that might otherwise run another year or so as far as ballast is concerned, may be raised in connection with the tie renewals so that the two operations can be carried on together. The desirability of advancing the renewal of ballast to accommodate tie renewals will obviously be governed by experience and good judgment.

A condition may be assumed where the ballast is of sufficient depth and clean, and the track is in good line and surface, but the ties poor, so that the only question is that of renewing the ties. In this case, a general raise would be desirable if every third tie requires renewal. This will permit the ties to be inserted easily and rapidly, and prevent the track from becoming choppy, as would be likely to happen if every third tie is dug in on a new bearing. However, it may be observed that track with good ballast and ties so poor that every third one needs to be renewed is seldom found.

are removed from the small openings at the time the filling is completed. Where the opening is larger and deeper, the removal of the old structure is deferred from a few weeks to several months. In all instances, however, the old structure is removed as soon as practicable, traffic being depended on to settle the fill.

Regardless of how long the old structure is allowed to remain after filling is completed, a slow order will be necessary for a few days after its removal. It is my experience, however, that a slow order is required for no longer time where the old deck is removed immediately after the filling is completed than where six to eight months elapse before its removal.

Gangs Self Contained

By District Engineer

Where only an occasional culvert is being installed, it is scarcely worth while to organize a specialized gang for this class of work. Almost every road has in its organization some foreman who is capable of making the installation and a regular gang can be assigned to do it. The placement of metal culverts does not require a high degree of training if the foreman is experienced, and generally the installation can be made by the section forces under the direction of a capable bridge foreman.

If the road does not have enough concrete work to have developed foremen qualified for this type of work, it will be better to build concrete culverts by contract. If a qualified foreman is available, company forces can be employed. In any of the foregoing cases the bridge carpenter gang should make the necessary alterations to the existing structure, as neither contractors nor section forces should be allowed to undertake any work on a structure involving safety of trains.

If a sufficient amount of culvert work is in prospect to warrant the employment of a special gang, such a gang should be organized. If the work consists only of placing metal or concrete pipe, the gang will consist principally of laborers, as it is unlikely that there will be sufficient carpenter work to keep the more skilled men busy. In this event, the culvert gang should not be allowed to make alterations to timber trestles or other types of structures over which trains must pass, and it will be necessary to call in a carpenter gang to make the alterations. In general, however, the culvert gang should be able to insert struts if they are required in the larger pipes.

Some years ago we replaced a large

Who Should Do The Work?

Where a concrete or a metal culvert is being installed to replace a timber trestle, should necessary alterations to the trestle be made by the culvert gang or by a bridge carpenter gang? Why?

Assigned as Required

By R. E. CAUDLE
Assistant Engineer of Structures, Missouri Pacific Lines, Houston, Tex.

Our bridge and building gangs do not specialize, but do all work required, including carpenter, concrete and paint jobs. For this reason our practices may be of interest to other roads which carry out varying degrees of specialization with respect to the gangs assigned to work on structures.

In making a concrete culvert installation one of our bridge and building gangs, consisting of a foreman, with the necessary number of carpenters, helpers and laborers is assigned to the project. The carpenters and helpers make the necessary alterations in the existing structure, build the forms and place the reinforcement. They also attend to the depositing, placement and tamping of the concrete and, finally, remove the forms and smooth any rough surfaces that may appear on the exposed concrete. The laborers do excavation, handle material,

transport the concrete and do other rough work while the job is under way.

Metal culverts of sufficiently small diameter as to require only a single section are placed by section gangs. If of larger diameter or of two or more sections which must be coupled at the time of installation, a bridge and building gang does the work. In the event that struts must be placed to prevent distortion, this gang also inserts them.

Small, shallow openings are usually filled by teams and scrapers, the earth being distributed around the piles and tamped around the culvert by a section gang as the filling progresses. Large, deep openings are filled by dump cars from the track level. In many cases, the filling material is moistened by sprinkling the earth filling somewhat heavily with water drawn from tank cars attached to the work train. Section men are employed to distribute the earth properly around the culvert and piles as the filling progresses.

If the filling material is of good quality, the caps, stringers and ties

August, 1937

549

Railway Engineering and Maintenance

number of open bridges with pipe culverts and concrete boxes. On this line many of the old masonry piers and abutments carrying steel spans also required renewal or replacement of the bridge seats. Under these conditions we found it desirable to place two or three gangs in the field for several years to do this class of work. We also found that we could get better results at less cost by making these gangs self-contained.

We selected foremen experienced in this class of work and reorganized their gangs to balance the skilled and ordinary labor, and then required the individual gangs to do all of the work on the projects to which they were assigned, except as noted later. This

included excavation for and placement of pipe culverts; all phases of the construction of concrete boxes; the construction of all falsework, except the driving of piles and, where necessary, the erection of temporary steel falsework spans, these latter jobs being handled by the pile-driving and structural-steel gangs, respectively, because of the special equipment required; and the construction and removal of all forms, and the placement of reinforcement and concrete. We found that this form of organization was more economical, since it eliminated interference with the work of other gangs and the sending of men for long distances to do a few hours or a few days work.

The extent to which the operator of a large machine should be expected to make repairs will also depend on the condition of employment. If the machine is put out of service and the operator is laid off at frequent intervals, practically no repairs or special care of the machine can be expected of him. On the other hand, if the job is reasonably stable but contingent on the machine being kept in good repair, operators can be selected and trained to do a large part of the repair work without outside help.

Two cases may be mentioned, one a large crawler-mounted dragline, equipped with one of the early and rather complicated Diesel engines, which has been in the shop only three times in 11 years. The other is a similar machine, but of improved design, equipped with a gasoline engine, which has not been in the shop during its entire 7 years of operation. Records almost as good can be cited for locomotive cranes, indicating that much can be expected of an operator of ability if he is trained properly.

Repairing Power Machines

To what extent should the operator of a power machine be expected to keep it in repair?

Require Skilled Mechanic

By C. E. MORGAN

Superintendent of Work Equipment and Welding, Chicago, Milwaukee, St. Paul & Pacific, Chicago

Power machines, as used today, require the service of skilled mechanics. The operator should know what the machine can be expected to do when working properly. He should be familiar with the parts list, know what each part looks like and its approximate cost. He should be able to judge whether a part is pressed into a housing or has only a light push fit. These are details which enable him to estimate intelligently how long the machine will be out of service when needing repairs.

It is important for him to know whether he has the tools necessary for making repairs, and whether repairs can be made during the evening and night so that the machine will be ready for the next working day. A good operator soon learns to form conclusions and to anticipate trouble; he also learns that oil is less expensive than parts.

An operator should be able to replace any broken part, and to know whether repairs can be made by brazing or welding and whether it needs preheating or postheating. Unless the gang is large enough to justify the assignment of a regular repairman, the operator must make many minor repairs alone. He must, therefore, be able to time his engine, change the magneto, change generators, set the charging rate, clean and adjust spark

plugs, adjust and clean ignition points and handle bearing, piston and ring work, and make other repairs that do not require precision or machine work, or heavy repairs that cannot be made in the field.

Depends on Machine

By E. H. MILLS

General Gas Engine Inspector, New York Central, New York

On the smaller machines, such as tie borers, adzers, nut runners, etc., the operator receives only a small differential above laborer's pay, which stops when the machine is not in use. Little can be expected of him, therefore, beyond running adjustments, cleaning and oiling and perhaps some small repair work, such as replacing fan belts, spark plugs, hose connections, etc., if he possesses the necessary skill. More extensive repairs should be made by regular repairmen.

On the larger machines which require a higher order of ability to operate them, the operator should be expected to make field repairs, alone if possible, or help the mechanic who may be assigned to do so. The extent to which he should do this work alone will depend in large part on his individual ability and resourcefulness. In general, it should include adjustment of valves, brakes, clutches, bearings, etc. The replacement of parts which do not require the use of shop equipment, special tools or additional help should be expected of operators.

Makes Light Repairs

By G. R. WESCOTT

Assistant Engineer, Missouri Pacific, St. Louis, Mo.

There are many conditions affecting the extent to which the operator of a power machine should be expected to keep it in repair. These include (a) the organization for the field maintenance of power machines on the railway; (b) whether the machine works singly in more or less isolation from other machines or gangs; (c) whether it is worked in connection with a gang, the progress of which depends on uninterrupted service from the machine; and (d) whether it is one unit of a group comprising the equipment of a fully mechanized gang, having a field mechanic or machine maintenance man assigned regularly to handle repairs.

The effect of these various conditions is obvious, but regardless of the organization or the type or use of the machine, any operator will find it necessary at times to insure that the unit will be kept in operation, to do many things which under other conditions would be done by a field mechanic.

For this reason, he should be able to (1) make ordinary adjustments, such as are required from time to time on any machine; (2) recognize the more obvious causes of failure of the machine to function properly; (3) select from the manufacturer's parts list the parts required to correct the failure; and (4) to apply these parts,

provided their application does not require the use of special tools or equipment.

On the other hand, to say that the operator should be capable of doing these things does not mean that he should be expected to do them regularly. The function of the operator of a machine is what the term implies—to operate it, not to operate on it. The test of whether these things should be done by the operator in the field is "by what method can the machine be returned to service more quickly?" In general, all work on the machine except that of keeping it clean, of keeping the bolts tight, and of keeping it in proper adjustment, should be the function of the field mechanic rather than of the operator.

To expect too much of the operator in the way of mechanical work on the machine tends to fix his mind on the maintenance of it rather than on its productiveness and, in some men, will develop a tinkering complex which may result in serious delays and loss

of productiveness. The operator should watch his machine closely and report promptly any broken or defective part that, if not attended to quickly, may interfere with the operation of the machine. Even in this, the responsibility should be joint with the field mechanic who, under a proper organization, will make a careful inspection of the machine at frequent and regular intervals.

The use of power machines has developed much faster on most roads than the organization for their maintenance, for which reason, in many cases, operators are doing much more of their own repair work than is economical. Furthermore, the maintenance work on any railway is so widespread in its scope that it is impracticable even under the best conditions to have a mechanic within reach at all times to make minor repairs. It is probable, therefore, that as in the past, operators of machines will have to continue to maintain them insofar as light repairs are concerned.

day intervals, while during periods when turbidity is high it is advisable to operate the sludge valve at weekly intervals. I am also familiar with a plant where four 4-in. outlet valves were installed in the floor of a flat-bottom tank which accumulated sludge rapidly. The valves were operated from the roof of the tank by lifting rods, the discharge being piped to an outlet a short distance from the tank. It was found that the weekly operation of these valves greatly decreased the number of times that it was necessary to empty the tank for complete cleaning.

In general, the most economical way to dispose of sludge is to discharge it directly into a running stream or onto low ground. If neither method is practicable, sludge pools will be required. These should be two or more in number so that they can be used and cleaned alternately. The water collecting on the top of the sludge may also be salvaged by repumping after it has clarified. The capacity of the pools should be sufficient to reduce cleaning to annual or semi-annual periods. Where a large amount of sludge is to be removed, a clamshell, a portable conveyor, a loading track or other methods should be considered. Where only a small volume of sludge accumulates, hand removal by a scavenger wagon may be economical. Considerable objection is usually made to discharging sludge into sewers, and this form of disposal is not recommended.

Cleaning Service Tanks

How often should service tanks be cleaned at a water-treating plant? What is the best way of disposing of the sludge?

At Least Once a Year

By J. P. HANLEY
Water Service Inspector, Illinois Central,
Chicago

Practices with respect to cleaning service tanks vary somewhat because they are affected by several conditions, including (a) the kind of treatment used, that is, lime-soda ash, zeolite or boiler compounds; (b) the number of tanks in service at individual water stations; (c) the character of the water, that is, the dosage required for treatment and the resulting volume of sludge; (d) the turbidity of the untreated water and whether the water is filtered, either before or after treatment; (e) and whether the tanks have conical or flat bottoms.

As a general rule, all tanks should be emptied and given a thorough inspection internally at least once a year, and they should be cleaned at this time if required. In some cases, where the water is clear, either naturally or because it has been filtered, tanks may not need cleaning for several years while under less favorable conditions they may need to be cleaned semi-annually. I am familiar with a water station where, because of the heavy dosage of compound,

the service tank must be cleaned every two months.

Treatment with lime and soda ash usually produces the greatest amount of sludge residue. Where two or more treating tanks are used in tandem, tank No. 1 will have the greatest amount of sludge and may require cleaning semi-annually. Tank No. 2 will accumulate sludge at a slower rate and an annual cleaning may suffice, while the roadside tank, No. 3, will receive practically clear water and may require cleaning at intervals of only two or three years. Boiler compounds generally precipitate considerable sludge in roadside tanks, and these tanks should be cleaned at least once a year, and often if required.

Zeolite treatment causes no precipitate but this form of treatment has a limited range, partly because it is not adapted for use with turbid waters, with waters having an initial pitting capacity or with waters having a high degree of hardness. However, the complete absence of sludge as a result of this treatment is an advantage which is decidedly in its favor.

Conical-bottom tanks are more economical to clean than those with flat bottoms, but because of the limited sludge storage space in the mud drum, they should be cleaned at about 30-

Should Prepare Schedule

By SIDNEY STONE
Plumber Foreman, Erie, Hornell, N. Y.

A schedule for cleaning tanks should be prepared, and this can best be done by the foreman in charge of the water plants on the district. Where the source of supply is a stream which carries a considerable load of sediment at certain periods, usually in the spring and fall, experience and observation will enable him to work out a schedule which insures that there will not be an excessive amount of sediment in the tanks at any time. Because the conditions surrounding the water supply are likely to vary, some tanks may require cleaning as often as once a month during certain seasons and less often at other seasons. Others will have intervals ranging from three or four months to two or three years.

On the other hand, every tank should be emptied for inspection at least once a year, at which time it is usually desirable to clean it also. I have found that it is also an asset to

have a schedule for cleaning water cranes. Where the water is not treated, it is desirable to clean and inspect cranes twice a year, making such repairs as may be needed at this

Railway Engineering and Maintenance

time. If the water is treated, there may be an advantage in doing this oftener. Where this practice is in effect, water crane failures are found to be a rare occurrence.

Ventilating Ice Houses

Should an ice house be ventilated? Why? If so, what is the best way to do it?

Should Be Insulated

By GENERAL INSPECTOR OF BUILDINGS

From long observation, I am convinced that it is good business to insulate ice houses more thoroughly than is usually done. As the size or importance of the icing facilities increases, the importance of insulation also increases. Certainly, artificial ice under refrigeration should be insulated thoroughly and should not be ventilated. On the other hand, because it is under refrigeration, it is equally important that the ice be stacked to allow circulation between the ice and the outer walls, and between the ice and the floor.

Ice houses for the storage of natural ice seldom have roof insulation, for which reason arrangements should be made for roof ventilation. This is done by placing ventilators in the roof and air intakes under the eaves, to prevent the accumulation of heated air above the ice during hot weather. No other form of ventilation should be provided, however, and doors should be kept closed except when in actual use.

Keep Air Circulation Down

By ENGINEER OF BUILDINGS

Obviously, the basic principle underlying the design of an ice house is to prevent the transmission of heat from the outside atmosphere to the stored ice. Ventilation will admit outside air, which during most of the year has a temperature above 32 deg., F., the melting point of ice. To preserve the stored ice, therefore, it is highly important that the admission and circulation of air into and through the building should be kept to the minimum. During periods of low temperature, that is, well below the freezing point, it is beneficial to admit outside air, since this will tend to reduce the temperature of the building itself and thus offset later temperatures higher than 32 deg.

It is so important to reduce the admission of warm air that there should

be only one entrance to an ice house and this should be as small as practical consideration will permit. In fact, I have heard it argued that this entrance should be in the form of a vestibule with outside and inside doors. This should not be misunderstood, for it is necessary that access shall be provided at different levels as the level of the ice is lowered through removal. The point is that

while this provision must be made, only the entrance at the current level should be in use, the design being such that all other levels will be closed.

As most ice houses are built, there is considerable open space between the top of the ice and the roof or, if the underside of the trusses is ceiled, there is a dead-air space between the ceiling and the roof. In either event, unless the roof is insulated adequately, the air in this space becomes highly heated during the summer, and this cannot fail to effect some shrinkage of the ice. For this reason, since the temperature of this air is higher than that of the outside air, roof ventilation will be beneficial. This should be accomplished by placing several ventilator stacks in the roof for the exit of the confined air, with an equal area of intake openings distributed along the sides of the building at about the level of the ice when the storage is at its maximum.

Paint on Ends of New Rails

What is the significance of the colors painted on the ends of new rails? Of unpainted ends? Where should each of these classes of rail be used?

Show Classification

By G. M. MAGEE
Assistant Engineer, Kansas City Southern,
Kansas City, Mo.

To avoid the economic waste of rejecting certain rails of inferior quality, which are suitable for service under proper restrictions, as well as to place more advantageously rails which are more suitable for specific uses, a system of classification and marking has been agreed on between the rail manufacturers and users, which is set up in the current rail specifications of the American Railway Engineering Association. These classifications, markings and suggestions or restricted uses follow.

Number 2 rails are those which have (a) slight surface imperfections, but which are not sufficient to cause their rejection; (b) more than 6 in. of camber before they are straightened; or (c) rails which have not been hot-stamped.

These rails have both ends painted white and the figure 2 is stamped on each end face. Number 2 rails are of inferior quality and should not be used in high-speed track. They may be used for turnout rails in low-speed turnouts, through station grounds or at other points where the speed of trains is restricted. If the full ton-

nage of these rails cannot be used at the points indicated, the remainder should be placed in the most favorable location available.

X-Rails are those rails for which the representative test specimen, when fractured, showed an inferior grain structure, or are rails which showed an inferior grain structure at either end or at any bolt hole, and were cut back to sound metal. These rails have both ends painted brown and the letter X stamped on each end face. X-Rails should be laid at points of restricted speed and their use should preferably be confined to slow-speed turnouts.

A rails comprise the first rail rolled from the ingot, that is from the metal at the top of the ingot. For this reason they are most likely to show evidence of segregation, that is, separation of the constituent parts of the steel. These rails must not be used on curves except at points where there is restricted speed. The ends of A rails are painted yellow.

Rails of first quality, but shorter than 39 ft., have both ends painted green. These rails should be used to preserve the proper spacing of joints on the inner rail of curves, or for the same purpose at bridges, crossings and turnouts. Aside from length there is no reason why they cannot be used in high-speed tracks.

High-carbon rails are rails of first quality of each heat in which the carbon content lies within the upper five points of the range permitted by the specifications. These rails have their ends painted blue, and they should be used to lay curves, giving preference to the sharpest curves, if the quantity of rail in this classification is not sufficient to lay all of the curves which require new rail.

Number 1 rails are full-length rails of first quality and do not have their ends painted unless they come under the foregoing classification for high carbon, in which event they will be painted blue. Number 1 rails are suitable for any use, but preference of location should be given to the foregoing classes in the manner which has been mentioned.

Individual rails are painted with one color only, and in the order of precedence which has been given, that is, No. 2 rails, X-Rayls, A rails, etc. For this reason an A rail or a short rail, if of No. 2 quality, will be painted white, not yellow or green. To avoid confusion in the distribution of the rail at the point of use, the specifications also require that rails of each classification shall be loaded into separate cars.

Use A.R.E.A. Markings

By O. H. BAKER

Manager of Sales—Chicago District, Railroad Materials and Commercial Forgings Division, Carnegie-Illinois Steel Corporation, Chicago

Rails cooled on the hot bed are marked in accordance with the requirements of the 1936 specifications for open hearth rails of the American Railway Engineering Association, that is, all rails are branded in the finishing pass to show the weight, the section number, the type, the kind of steel, the manufacturer, the mill, and the year and month rolled. After they leave the finishing pass, they are hot-stamped on the opposite side from the brand, to show the heat number, the position of the rail in the ingot, and the ingot number.

In addition, the ends of rails cooled on the hot bed are painted to indicate their classification, as follows:

No. 1, 39 ft.—unpainted.

No. 1, less than 39 ft.—green.

No. 2, white, and stamped with the figure 2 on both end faces.

X-Rayls, brown, and stamped with an X on both end faces.

A rails, yellow.

All rails of a heat in which the carbon content is in the upper five points of the specified carbon percentage have the ends painted blue.

In addition to the marks specified

for rails cooled on the hot bed, Brunorized rails having the ends hardened are hot stamped on the same side with the heat number with the letters BN, and are marked on the web with aluminum paint. If these rails do not have hardened ends, they are stamped with the letter N and marked with aluminum paint on the web.

Again, in addition to the markings specified for rails cooled on the hot bed, controlled-cooled rails without hardened ends are hot-stamped on the same side with the heat number with

the letters CC, and are painted on the same side of the web with red paint. Controlled-cooled rails which have the ends hardened are stamped on the same side with the heat number with the letters CH, and the same side of the web is painted red.

All Brunorized and controlled-cooled rails, hot stamped to indicate the process, which are not fully treated, are stencilled on the side of the web bearing the heat number "Hot Bed Cooled," and are accepted in this classification.

Which Gives Best Bearing?

What are the relative merits of sheet lead, iron rust and cement grout for distributing the bearing load on bridge seats? What are their limitations?

Prefers Dry Cement

By P. G. LANG, JR.

Engineer of Bridges, Baltimore & Ohio, Baltimore, Md.

It is well first to examine the problem to determine the reasons for placing any such material. In practically all cases the bottom of the steel bearing for any bridge superstructure is a plane surface which is reasonably smooth. With few exceptions, this surface must, of necessity, rest upon masonry. It seems manifest that the masonry cannot be finished as nicely as the steelwork which rests upon it, that is, the surface of the masonry itself has certain inaccuracies in it. Furthermore, it may not be quite to the proper elevation or exactly a plane surface.

Review of a considerable number of specifications issued since 1890 indicates that until after the turn of the century, say to 1905, the use of sheet lead was quite general, and even today some specifications call for the use of sheet lead. At present, many specifications, notably highway specifications, contain the following:

Thoroughly swab the bridge-seat bearing area with red-lead paint and place upon it three layers of 12 or 14-oz. duck, each layer being swabbed on its upper surface with red-lead paint, and place the superstructure shoes and pedestals in position while the paint is plastic.

This treatment is somewhat similar to the use of sheet lead, that is, essentially, it interposes between the steel bearing and the masonry a material having some yielding qualities, but nonetheless a material that has a definite and uniform thickness over the entire area. While such a material will take up small inequalities in the

surface of the masonry bearing area as finished, it does not provide a varying thickness to take up inequalities in elevation or in producing a plane surface.

Both sheet lead and canvas are somewhat foreign to the general run of materials in use for bridge construction. They are, in themselves, somewhat costly and, in addition to their cost, entail the securing of such alien materials. From observation, it is believed that eventually sheet lead will squeeze out entirely from under the bearing surface and thus tend to defeat the purpose for which it was used. This is not true of canvas and red-lead paint, however.

Iron rust and cement grout perform all of the essential services, and in addition are materials readily adaptable to the varying thicknesses over the bearing area. It must be borne in mind, however, that the minimum of these materials must be used. Dry cement is probably the best material for this purpose.

Generally, at present, all bridge seats are of concrete. They should be finished as nearly as possible to the elevation required. This means that to secure the proper elevation, the bridge seat must be finished slightly higher than the bearing area. After the concrete has hardened, it becomes necessary to outline the bearing areas, and to chip or bush-hammer these areas down to the required elevation. At the time the steel is set, this area is covered with dry portland cement. The steel is then placed and, in time, atmospheric moisture will be sufficient to set the small quantity of dry cement under the bearing area. This has been our practice for several years, and no difficulty has ever been encountered; in fact, it seems to afford a satisfac-

tory solution. Furthermore, it is simple to apply, and cement is a material that can be obtained readily in connection with bridge work.

Does not Use Sheet Lead

By GENERAL INSPECTOR OF BRIDGES

We quit using sheet lead many years ago, except on old stone bridge seats where the cut-stone surface has so many irregularities that the surface cannot be given a smooth surface without cutting too deeply into the masonry, thus leaving a bad drainage condition, which requires channels from the bearing to the edge of the masonry. One of the difficulties connected with the use of sheet lead is its tendency to flow under the loading to which it is subjected, sometimes causing cast bed plates to break. This is an asset, however, on rough-cut stone bearings, where the lead is

pressed readily to fit the many surface irregularities. Iron rust is equally useful on old bearing surfaces to bring them back to level and to the proper elevation, especially since it is so easily applied.

All of our newer substructures are built of concrete, which can be finished much more exactly than stone. Where we find any irregularities in concrete bridge seats we spread a thin film of dry cement which, experience has shown, eventually sets as hard as cement grout. We used cement grout for some time until we found that the dry cement is fully as satisfactory and is more easily applied. Some of the highway specifications require heavy canvas coated with red lead as the bearing medium under bridge shoes, but I do not favor this practice, since it does not afford opportunity to level the shoes as readily as the dry cement, and any movement of the shoes is likely to abrade it.

tion that water reaching the track will drain away freely. This, then, means that the cleaning of the cribs is of equal importance, so that water will drain as freely from them and find an outlet through the shoulder.

This brings us to the inter-track space, the ballast here being simply enclosed shoulders which do not have the same free outlet as the outer shoulders. For this reason, the depth to be cleaned will be determined by several conditions. On an old roadbed ballast has been applied from time to time and the lower strata under the ties are generally compacted and fouled to such an extent that they are practically impermeable, or at best permit the passage of water too slowly to allow the quick drainage necessary to first-class track. While the outer shoulder can and should be cleaned down to the subgrade, it may not always be advisable to carry the cleaning of the inter-track space to the same depth.

This will depend again, however, on drainage. It is my observation that while it may not always be advisable to clean the inter-track space approximately to the subgrade it is desirable to do so. In other words, if the condition of the ballast does not permit free drainage to the outside, or subsurface drainage is not available, cleaning much below the bottom of the ties will merely entrap water between the tracks and tend to aggravate the condition it was sought to improve.

If, on the other hand, the roadbed is constructed of such porous material that water will seep quickly from the inter-track space, or if adequate drainage has been installed in the more impervious roadbed materials, the cleaning should be carried almost to the subgrade. This indicates the importance of inter-track drainage. I am aware that not a few multiple-track lines have been operated for years without the installation of such drains, but I have never seen a case where conditions could not have been improved on lines having more than two tracks by installing drains, except where the roadbed has sufficient porosity to care for the water, and in many instances artificial drainage is vital to good track. In general, longitudinal subsurface drains with outlets at relatively short intervals, say several hundred feet, give best results. This is especially important at points where water tends to collect at or near the foot of a grade and at the upper ends of bridges on grades. I prefer perforated corrugated pipe for inter-track drainage, for it is not subject to distortion in the same measure as the shorter lengths of vitrified pipe.

How Deep to Clean Ballast

When cleaning ballast on multiple-track lines, to what depth should the inter-track space be cleaned? Why? Should provision be made for drainage? If so, what?

May be Governed by Cost

By L. J. DRUMELLER

Division Engineer, Chesapeake & Ohio, Hinton, W. Va.

When cleaning ballast on multiple-track lines with machines, so far as cost is concerned there is little difference between cleaning to subgrade and to a point well above subgrade. Machines for cleaning ballast are designed to clean to a depth of 24 in. below the top of tie, or to any shallower depth desired. It is my experience that a better job can be done by carrying the cleaning to within a few inches of the standard subgrade, but in no case should it be carried below the elevation of the shoulder of the roadbed.

If the ballast in the inter-track space is cleaned by hand, as sometimes becomes necessary in special cases, the depth to be cleaned will usually be governed, in some measure at least, by the cost, since the cost will increase as the depth increases. For this reason, the depth to which the cleaning can be carried will be influenced by the cost that can be justified as well as by the physical conditions. In general, this is a purely local problem.

Since the purpose of cleaning ballast is to provide better drainage, the

depth should extend to within a few inches of the subgrade, and when the subgrade is not sufficiently porous to absorb the water falling on the track, and at breaks in the profile where water may collect, suitable parallel drains should be installed between the tracks with outlets at proper intervals. Such drains should be constructed of perforated pipe, second-hand boiler flues or French drains.

Drainage Necessary

By ENGINEER MAINTENANCE OF WAY

Ballast is cleaned for only one reason—to insure satisfactory drainage. Drainage is, therefore, the basis for every phase of the cleaning operation and everything else that may be done is incidental to this primary purpose. Starting with the shoulder, full benefit from the cleaning cannot be realized unless it is left in such condi-



New Products Of the Manufacturers



Modified Bars For Worn Rail

THE Rail Joint Company, Inc., New York, has developed new features of joint bar design which are now incorporated in bars intended primarily for replacement work in conjunction with rehabilitating worn rail. The outstanding new feature is a crowned overfill for a specified length through the center portion of the heads of the bars to compensate for wear in the rails to which the bars are to be applied. This crowned overfill through the center portion of the bars is combined with a uniform amount of overfill throughout the length of the head-contact portions of the bars.

In order to meet varying conditions, three distinct types of bars incorporating the above features are offered, these being head-contact, controlled-bearing bars; head-contact bars; and headfree bars. In the case of the head-contact, controlled-bearing bars, there is provided, in addition to overfill at the three contact portions of the head, a crowning effect in the head, which is confined to the center contact portion of the bars. This design provides not only for ordinary wear throughout the length of the rail head fishing, but also takes care of the additional wear which is in-

variably to be found on the underside of the rail heads at the ends of the rails.

In the case of full head-contact bars, the new design, in addition to providing overfill for the entire length of the bars, provides a crowned central portion only, which, as in the case of the head-contact, controlled-bearing type of bars, is intended to compensate for the additional wear on the underside of the rail head at the ends.

In the case of the new design of headfree joint bars, overfill is provided throughout the length of the bars to compensate for normal wear in the rail fishing, and, in addition, additional overfill is provided on the inner face of the head through the central portion to insure positive full contact through that part of the rail fishing which is subject to the greatest wear. This latter feature is said to bring about a certain amount of spring action in the joint when the bars are drawn up, which insures holding them in tight contact with the rail at all times.

The new features of design can be incorporated in bars of any section or weight, including the toeless and full-flange types. It is claimed that the crowned overfill in the center section of the different types of bars is par-

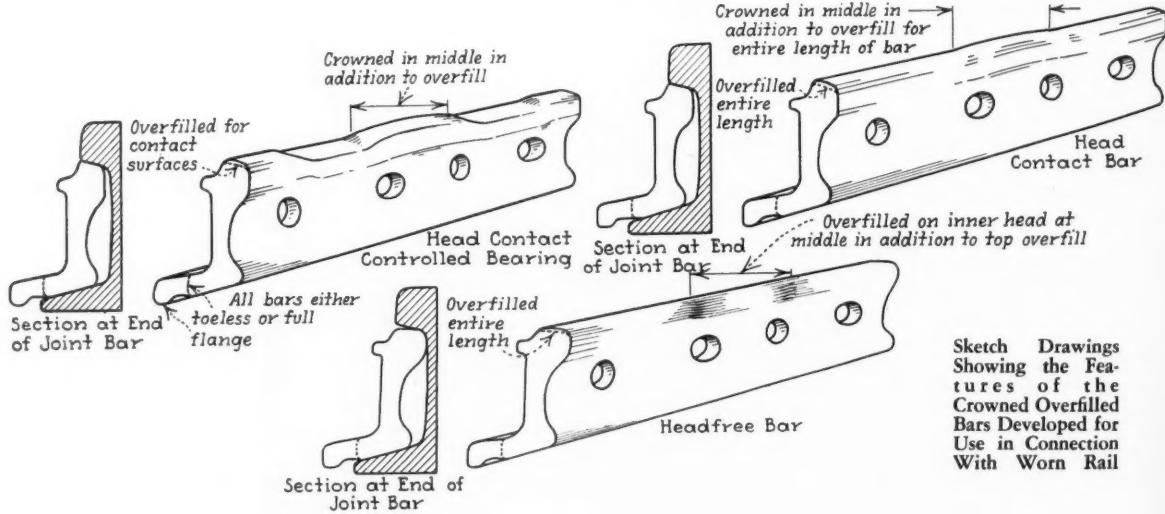
ticularly effective in restoring good joint conditions in old rail, and much more so than is possible with ordinary overfilled bars.

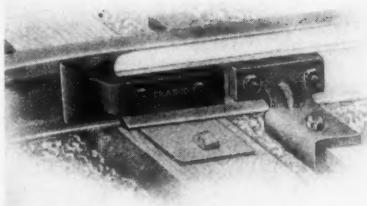
Switch Point Protector Improved

THE Track Specialties Company, New York, has improved the design of its Trasco safety switch point protector so that it now has a more secure attachment to the switch point and a firmer bearing against the running rail when the switch is closed.

This type of safety switch point protector, as shown in the accompanying illustration, is bolted to the switch point through the first two holes provided for the interlocking front foot, and only comes into play or is subject to wear when the switch is closed for turnout movements.

Since the protector has no physical contact or connection with the through rail when the switch is open, it can be applied in high-speed main-line track without affecting the safety of operation in any way, and for the same reason, its life is determined solely by the wear absorbed during turnout movements. It can be applied to interlocked switches as well as those not





The Improved Trasco Switch Point Protector

interlocked. In the former case the protector is held between the reinforcing strap and the interlocking front foot.

In the new design, the body, or attaching arm, is made sufficiently deep to have full bearing on the base of the point rail, supplementing the strength of the attachment to the point rail that is afforded by the bolts and washers.

At the same time, the depth of the head of the protector has been increased so that in the closed position of the protector against the stock rail, it has bearing along its base on the base flange of the stock rail.

The new model is made of manganese steel and, in the closed position, lies between the actual point of the switch and the theoretical point of switch, where it does not encroach upon the gage of the track.

F-M Diesel Engine

FAIRBANKS, MORSE & CO., Chicago, have introduced a new Diesel engine, designated as Model 42-E, which is designed to fill the need for a small heavy-duty, continuous-service stationary engine. The new engine is available in two and three-cylinder combinations with ratings of 60 and 90 hp., respectively, at 450 r.p.m. It has an 8 3/4-in. bore

Railway Engineering and Maintenance

and 10 1/2-in. stroke, and can be furnished for use with a direct-connected, belt drive or an electric-generator drive.

This new engine is characterized by simplicity of design and operation. It incorporates direct airless fuel injection and two-cycle design with crank case scavenging. Since there is a power impulse on each downward stroke it is said that a uniform output of power is assured without the use of an abnormally large flywheel. Also the cylinder heads are simplified as a result of the elimination of the air inlet and exhaust valves. All working parts are enclosed and yet are said to be readily accessible for inspection and maintenance.

Other features of the new engine are a completely automatic lubricating system; large main bearings; needle or quill roller-type piston pin bearings; governor control of speed at all loads; and completely water-jacketed cylinder and head with large passages to allow free circulation. It is claimed that the engine will operate continuously at rated capacity with no danger of becoming overheated or of straining any of the parts.

Acid Resisting Floor

THE Flexrock Company, Philadelphia, Pa., has developed a new flooring material, called Rockflux, the outstanding feature of which is its acid-resisting qualities, although, it is said that the new material produces a hard wear-resisting surface which is capable of sustaining heavy loads.

The floor material is a mixture of diabase (lava rock which has been under high pressure) and quartz, two acid-resisting substances, combined with a newly developed flux, which itself has been deprived of practical-

ly all calcium and other elements affected by acids.

The new material is furnished ready-mixed for trowel application, and is recommended for both continuous new coverings over concrete floors, and for making repairs to concrete floors. As a continuous floor covering, a thickness of one inch is recommended, while for patchwork, a thickness of one-half inch has been found adequate. It is said that Rockflux floors can be put in service in 24 hours or less time after laying, depending upon the character of traffic to which they are to be subjected.

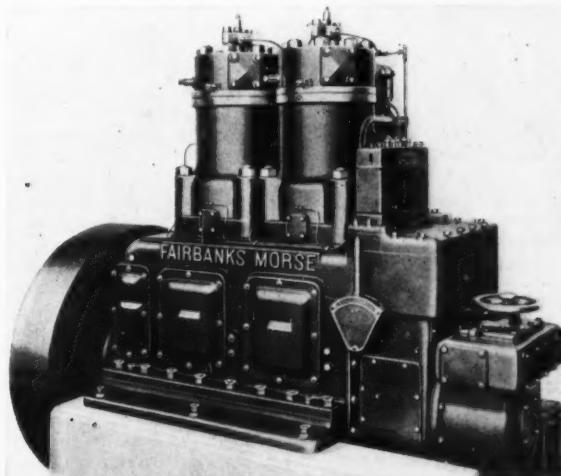
New Book

New A.R.E.A. Manual

MANUAL of the American Railway Engineering Association. 6 1/2 in. by 9 in., 1680 pages, illustrated. Bound in a loose-leaf binder with leather covers. Published by the association, 59 East Van Buren street, Chicago. Price—first copy to members in good standing \$4. Additional copies to members in good standing, copies to members not in good standing, to railroad employees (non-members), colleges, railroads, railroad organizations and libraries \$7. To all others \$10.

This is the first appearance of the manual of the American Railway Engineering Association (Construction and Maintenance Section of the Association of American Railroads) in loose-leaf form. It comprises a compilation of such portions of the work of the various committees as have been adopted as recommended practice at the association's annual conventions, and includes designs, plans, specifications, principles and practices. The present volume is complete except for the material prepared by the Committee on Rules and Organization, now being revised, and additions and changes resulting from action taken at the convention in March, it being the intention to supply the sheets covering the changes made each year as soon as they have been printed. With respect to matters relating to Signals and Interlocking, and Electricity, cross reference is made to the manuals of the Signal and Electrical sections of the A.A.R.

The new manual differs from the earlier volumes in that the work of each committee is presented in a separate section, segregated for convenience by blue sheets, and each section is paged to identify the committee as well as the folio. In addition, all definitions have been assembled in a consolidated glossary.



The Fairbanks, Morse Model 42-E Diesel Engine

News of the Month

"Seeing Eye" Dogs Now Allowed in Passenger Cars

President Roosevelt has approved an amendment to the Interstate Commerce Act which will permit blind persons to take "seeing-eye" dogs with them in coaches and Pullman cars, under regulations of the Interstate Commerce Commission. The bill was passed by the Senate on June 28 after having been approved by the House of Representatives three weeks earlier.

Railroad Income Shows Gain in May

For May the Class I railroads of the United States had a net operating income of \$43,662,959, which was at the annual rate of return of 2.21 per cent on their property investment, as compared with a net of \$41,797,047, or 2.13 per cent, in May, 1936, according to figures compiled by the Bureau of Railway Economics of the Association of American Railroads. Gross operating revenues for May amounted to \$352,613,641 as against \$320,926,403 in May, 1936. Operating expenses in May totaled \$267,296,443 as compared with \$240,201,794 in the same month of 1936.

To Convert Railroad Roadbed into Toll Highway

The conversion of 164 miles of old railroad roadbed into a four-lane toll highway is authorized in legislation recently passed by the legislature of the Commonwealth of Pennsylvania. The roadbed involved is that of the defunct Southern Pennsylvania, extending from Carlisle, Pa., near Harrisburg, to a point 20 miles east of Pittsburgh, which was constructed in 1881 by W. H. Vanderbilt of the New York Central. Construction activities were abandoned in 1885 before any track was laid. The highway will cost approximately \$50,000,000 and will be under the control of the Pennsylvania Turnpike Commission.

Shippers Expect Larger Loadings in Third Quarter

Freight car loadings in the third quarter of 1937 are expected to be about 7.9 per cent above actual loadings in the same quarter in 1936, according to estimates compiled by the 13 Shippers' Regional Advisory Boards. On the basis of these estimates, freight car loadings of the 29 principal commodities in the third quarter

will be 6,539,536 cars, as compared with actual loadings of 6,058,300 cars during the corresponding period of 1936. All of the 13 boards anticipate increases in car loadings for the third quarter as compared with the same period last year. The greatest increase anticipated by any board is that of the Northwest region, which estimates that freight car requirements in that region in the third quarter will be 29.5 per cent above the same period in 1936, due in large part to the heavier movement of grain, and ore and concentrates. Of the 29 commodities included in the estimate, increases are expected in 24 and decreases in 5.

Switchman Gets Medal of Honor

Upon recommendation of the committee on award of medals of honor, and with the approval of the Interstate Commerce Commission, President Roosevelt has awarded a medal of honor to Arnold F. Haack, of Superior, Wis., a switchman on the Chicago, St. Paul, Minneapolis & Omaha. The medal was awarded under the act of 1905, which provides for bronze medals of honor to be awarded for outstanding feats of bravery in connection with the saving of life upon railroads. The act which resulted in this award was performed on January 7, 1937, at the Tower Avenue crossing of the C. St. P. M. & O., in Superior, where Switchman Haack rescued from beneath the truck of a freight car a 53-year-old woman who had been struck down as she ran onto the crossing after a dog.

Carriers Are Keystone Of Private Enterprise

A warning to business that it must protect the solvency of the railroads to forestall government ownership of the carriers and the evils that would inevitably follow was delivered by Donald D. Conn, executive vice-president of the Transportation Association of America, in an address at Chicago on June 30. Mr. Conn traced the development of regulation of the railroads and said that only two more steps remained to be consummated in the trend toward full control of the railroads by the government. These are (1) management of the carriers by the government and, (2) outright ownership. "Then," he said, "would come the deluge. Experience in many countries indicates that it would be a deluge of red ink. When it mounted so high as to threaten the treasury of the state, the loss would be written off, de-



frayed by the taxpayers, all forms of transportation set up again under private enterprise and the process would begin all over."

"Transportation," said Mr. Conn, "is the 'front line trench' of private enterprise." "In a nation as far-flung as the United States," he said, "it is the keystone in the arch of private enterprise."

Railroads Participating Extensively in Fairs

The railroads, the Pullman Company and the Railway Express Agency are participating extensively in the various fairs and expositions now in progress through the country and are making plans for further representation in fairs to be opened soon. At the Greater Texas and Pan-American Exposition, which opened at Dallas, Tex., on June 12 for a second year, 10 railroads and the Railway Express Agency are exhibiting. At the Great Lakes Exposition which opened at Cleveland on May 28 for its second year, railroads are represented by an exhibit of the Association of American Railroads. The Railway Express Agency also has an exhibit at this exposition. Even more pronounced will be the railways' participation in San Francisco's 1939 Golden Gate International Exposition and the New York World's Fair to be held in 1939. Three railroads—the Southern Pacific, the Union Pacific, the Great Northern—and the Pullman Company will exhibit at the Golden Gate Exposition and in addition have subscribed \$125,000, \$50,000, \$25,000 and \$50,000, respectively. It is expected that the New York World's Fair will present to the public more individual railroad exhibits than any exposition held thus far.

President Signs Carriers' Taxing Act

The final step in the process of converting into law the labor-management compromise agreement on railway pensions was consummated last month when President Roosevelt signed the Carriers' Taxing Act of 1937. This act levies taxes on the railroads and their employees for the purpose of securing funds to finance the Railroad Retirement Act, companion measure to the Carriers' Taxing Act, which was recently passed by both houses of Congress and signed by the President. As a consequence of this legislation, railroad employees now have a pension system which the carriers are committed in the compromise agreement to leave unmolested by attack in the courts.

One of the provisions embodied in the new tax law provides for the return to railroad employees of funds collected by the railroads under the taxing act of 1935, which have been kept intact in non-interest bearing accounts by the railroads since the act was held unconstitutional by the federal court for the District of Columbia. The refunds will comprise the $3\frac{1}{2}$ per cent wage deduction made between March 1, 1936, and January 1, 1937, plus the $3\frac{1}{4}$ per cent excess between January 1 and June 29 of the abandoned taxing rate over the $2\frac{3}{4}$ per cent of the new act, which is retroactive to January 1.

Association News

International Railway Maintenance Club

The next meeting of the club will be held on August 12, at the Hotel Royal York, Toronto, Ont., Canada.

Roadmaster's Association

Members of the Executive committee, together with officers of the Track Supply Association, met with President B. E. Haley at the Hotel Stevens, Chicago, on July 10, to formulate plans for the fifty-second annual convention, which will be held at that hotel on September 14-16.

Arrangements were made to extend invitations to several railway officers to present addresses on pertinent maintenance problems supplementing the committee reports. It was decided to hold an informal session on Tuesday evening to take the form of a Question Box, at which questions submitted by members will be presented for discussion. A banquet will be tendered the members of the association by the Track Supply Association on Wednesday evening, at which it is proposed to present an address by a prominent railway executive.

Tentative drafts of reports were received from four of the five committees, which reports were discussed in detail and then referred back to the committees, with suggestions, for completion.

American Railway Engineering Association

Practical experience in keeping the manual up to date will be afforded all holders of the new loose-leaf volume by the middle of August, when they will receive the first supplement of some 75 pages. Because questions have been raised concerning the correction of the alphabetical index, it is of interest to note that the supplement will be accompanied by a one-page supplement to the index, it having been decided to revise the index in its entirety only every alternate year. The volume of proceedings of the 1937 convention will be mailed to members about the same time.

The board also decided to continue the plan of an annual luncheon on the second day (Wednesday) of the convention instead of a dinner, and accepted the invitation of the Western Railway Club to a dinner and meeting to be conducted under the auspices of that organization on Wednesday evening of convention week. Favorable action was taken also on the invitation tendered by the National Railway Appliances Association to a luncheon at the Saddle and Sirloin Club on the Monday noon before the convention, for all members of the A.R.E.A. who will be in Chicago on that day.

Eight committees held meetings in July as follows: Yards and Terminals, at Syracuse, N.Y., on July 12; Track, at Cincinnati, Ohio, on July 12 and 13, including

Railway Engineering and Maintenance

an inspection of the main line of the Chesapeake & Ohio on a new track inspection car; Buildings, at Boston, Mass., on July 13 and 14; Iron and Steel Structures, at Detroit, Mich., on July 15 and 16; Waterways and Harbors, at Chicago, on July 20; Maintenance of Way Work Equipment, at Pittsburgh, Pa., on July 20; Waterproofing, at Chicago, on July 22 and 23; and Records and Accounts, at Toronto, Ont., on July 29 and 30.

Bridge and Building Association

Fifteen officers of the association and chairmen of committees gathered in Chicago on July 24 to complete plans for the forty-fourth annual convention, which will be held at the Hotel Stevens, Chicago, on October 19-21. Invitations will be extended to three or four railway officers of prominence to address the convention, supplementing the eight committee reports that will be presented.

It was decided to hold a special session on Tuesday evening, at which talking-moving picture films will be presented on some of the outstanding recently completed bridges. An association luncheon will be held on Wednesday, at which a railway executive will be invited to address the group. The annual dinner of the association and the Bridge and Building Supply Men's Association will be held on Wednesday evening. A trip of inspection to one or more of Chicago's industries making materials for bridge, building and water service use is planned for Thursday afternoon.

Bridge and Building Supply Men's Association

Although the invitation has been in the mails only a short time, 27 companies have already arranged to exhibit at the convention of the American Railway Bridge and Building Association at the Hotel Stevens, Chicago, on October 19-21. This is a larger number of companies than has arranged for exhibits at this time in any previous year. With more commodious quarters available, plans are being made for the most comprehensive exhibit of bridge and building materials in the history of this organization. Further application for space should be addressed to W. S. Carlisle, secretary, care of the National Lead Company, 900 West 18th Street, Chicago.

The companies which have arranged for space to date are as follows:

Binks Manufacturing Company, Chicago
Dearborn Chemical Company, Chicago
Detroit Graphite Company, Detroit, Mich.
Paul Dickinson, Inc., Chicago
Joseph Dixon Crucible Company, Jersey City, N. J.
Duff-Norton Manufacturing Company, Pittsburgh, Pa.
E. I. DuPont de Nemours & Co., Wilmington, Del.
Fairmont Railway Motors, Inc., Fairmont, Minn.
Ingersoll-Rand Company, New York
Insulite Company, Minneapolis, Minn.
Johns-Manville Sales Corporation, New York
Joyce-Cridland Company, Dayton, Ohio
Koppers Company, Pittsburgh, Pa.

The Lehon Company, Chicago
Mall Tool Company, Chicago
Massey Concrete Products Corporation, Chicago

Master Builders Co., Cleveland, Ohio
Modern Supply Company, Chicago
National Lead Company, Chicago
Otley Paint Manufacturing Company, Chicago

Oxweld Railroad Service Company, Chicago
Pittsburgh Plate Glass Company, Pittsburgh, Pa.

Railway Engineering & Maintenance, Chicago
The Ruberoid Company, Chicago

Thompson & Company, Oakmont, Pa.
Timber Engineering Company, Washington, D. C.

U. S. Gypsum Company, Chicago
U. S. Wind Engine & Pump Company, Batavia, Ill.

The Track Supply Association

Fifty-eight manufacturers of track supplies had reserved 68 spaces prior to July 26 in the annual exhibit of the Track Supply Association which will be held at the Hotel Stevens, Chicago, on September 13-16 coincident with the convention of the Roadmasters and Maintenance of Way Association, insuring a more comprehensive exhibit than in any recent year, according to Dan J. Higgins, secretary-treasurer of the association, 332 South Michigan avenue, Chicago. The companies which have taken membership to date are as follows:

Air Reduction Sales Company, New York
American Chain Co., Inc., Bridgeport, Conn.
American Fork & Hoe Company, Cleveland, Ohio
American Hoist & Derrick Company, St. Paul, Minn.
The Austin Western Road Machinery Co., Aurora, Ill.
Barco Manufacturing Company, Chicago
Blatford Corporation, Chicago
The Buda Company, Harvey, Ill.
Carnegie-Illinois Steel Corporation, Pittsburgh, Pa.
Caterpillar Tractor Co., Peoria, Ill.
Chicago Pneumatic Tool Company, New York
Chipman Chemical Company, Inc., Bound Brook, N. J.
Cleveland Tractor Co., Cleveland, Ohio
The Creepcheck Co., Inc., Hoboken, N.J.
Crerar Adams & Company, Chicago
Cullen-Friestadt Company, Chicago
A. P. DeSanto & Sons, Chicago
The Duff-Norton Manufacturing Company, Pittsburgh, Pa.
Eaton Manufacturing Company, Massillon, Ohio
Elastic Rail Spike Corporation, New York
Electric Tamper & Equipment Company, Ludington, Mich.
Fairmont Railway Motors, Inc., Fairmont, Minn.
Hayes Track Appliance Co., Richmond, Ind.
Hubbard & Company, Pittsburgh, Pa.
Illinois Malleable Iron Co., Chicago
Industrial Brownhoist Corporation, Bay City, Mich.
Ingersoll-Rand Company, New York
Inland Steel Company, Chicago
International Harvester Company, Chicago

O. F. Jordan Co., East Chicago, Ind.
Kalamazoo Railway Supply Co., Kalamazoo, Mich.
Lima Locomotive Works, Inc., Lima, Ohio
The Lundie Engineering Corporation, New York
Maintenance Equipment Company, Chicago
Mall Tool Company, Chicago
Metal & Thermit Corporation, New York
Morden Frog & Crossing Works, Chicago
Morrison Railway Supply Corporation, Buffalo, N. Y.
National Lock Washer Co., Newark, N. J.
Nordberg Manufacturing Company, Milwaukee, Wis.
Northwestern Motor Company, Eau Claire, Wis.
The Oxweld Railroad Service Company, Chicago
The P. & M. Company, Chicago
The Pocket List of Railroad Officials, New York
The Q. & C. Company, New York
The Rail Joint Company, New York
The Rails Company, New York
Railway Engineering and Maintenance, Chicago
Railway Track-Work Company, Philadelphia, Pa.
Ramapo Ajax Corporation, New York
Republic Steel Corporation, Cleveland, Ohio
Sellers Manufacturing Company, Chicago
Teleweld, Inc., Chicago
Templeton Kenly & Co., Ltd., Chicago
The Texas Company, New York
Warren Tool Corporation, Warren, Ohio
Western Railroad Supply Co., Chicago
Woodings-Verona Tool Works, Verona, Pa.

Railway Tie Association

At a meeting of the corporate members of the Railway Tie Association at Louisville, Ky., on June 29, R. H. White, Jr., president of the Southern Wood Preserving Company, Atlanta, Ga., was elected president; Meyer Levy, vice-president of T. J. Moss Tie Company, St. Louis, Mo., first vice-president; and Walter H. Firmin, Wyoming Tie & Timber Company, Metropolis, Ill., second vice-president. T. J. Turley, Jr., vice-president of Bond Brothers Company, Louisville, Ky., R. M. Killeen, Wood Preserving Corporation, Charleston, S. C., H. Tom Merritt, sales manager of Bond Brothers Company, Louisville, Ky., R. M. Hamilton, Vice-president of T. J. Moss Tie Company, St. Louis, Mo., and Leonard Perez, National Lumber & Creosoting Company, St. Louis, Mo., were elected members of the Executive committee. The Executive committee re-elected Roy M. Edmonds, St. Louis, as secretary-treasurer.

The association went on record in opposition to the Black-Connery Bill on the ground that it would increase the labor cost of tie production at least 25 per cent. The association also voted to formulate specifications for crossties which should be based upon the 1934 A.R.E.A. specifications and instructed its committee to take up with the Tie committee of the A.R.E.A. those revisions in the existing specifications for crossties which they believed advisable.

Personal Mention

General

A. J. Neff, work equipment foreman on Erie at North Hawthorne, N. J., has been appointed to the newly-created position of supervisor of work equipment for the Denver & Rio Grande Western with headquarters at Denver, Colo.

Albert Legault, roadmaster on the Canadian Pacific, with headquarters at Montreal, Que., has been promoted to assistant superintendent of the Laurentian division with the same headquarters. Mr. Legault was born on August 6, 1892, at Smiths Falls, Ont., and was educated at McGill University, graduating in 1916. During the summer vacations of 1914 and 1915 Mr. Legault served with the Canadian Pacific as a transportation student, returning to this company in the same capacity in 1916, following his graduation. In July, 1917, he left railway service to join the Royal Flying Corps, where he attained the rank of flight lieutenant. In 1918 he was sent overseas, returning to Canada in 1919, where he resumed his service with the Canadian Pacific. During the next four years Mr. Legault served during the summer months as inspector of rock ballasting operations and during the winter seasons as assistant chief clerk to the superintendent at Toronto, Ont., and as yardmaster at Smiths Falls, Ont. In 1925 he was appointed roadmaster on the Farnham division, being transferred two years later to the Laurentian division, where he was located at the time of his recent appointment to the position of assistant superintendent.

Engineering

L. V. Lienhard, roadmaster on the Atchison, Topeka & Santa Fe at Pueblo, Colo., has been appointed acting division engineer, with headquarters at Dodge City, Kans., to succeed **R. G. Whyman**, who has been granted a leave of absence.

P. P. Wagner, assistant engineer on the Missouri Pacific at Osawatomie, Kans., has been appointed acting division engineer of the Wichita division with headquarters at Wichita, Kans., to succeed **E. B. Fithian**, who has been granted a leave of absence.

F. U. Mayhew, formerly a division engineer on the Chicago Great Western, has been appointed chief engineer of the Minneapolis, Northfield & Southern, the Minnesota Western and the Electric Short Line Terminal Company, with headquarters at Minneapolis, Minn., to succeed **M. W. Peterson**, who has been assigned to the traffic department.

P. X. Geary, assistant division engineer of the Ft. Wayne division of the Pennsylvania, with headquarters at Ft. Wayne, Ind., has been promoted to division engineer of the Delmarva division, with headquarters at Cape Charles, Va., to succeed

J. E. Vandling, who has been transferred to the Buffalo division at Buffalo, N. Y., where he replaces **C. J. Henry**. Mr. Henry has been transferred to the Panhandle division, with headquarters at Pittsburgh, Pa. **J. L. Cranwell**, assistant to division engineer in the office of the vice-president (operation) at Philadelphia, Pa., has been transferred to the Ft. Wayne division, with headquarters at Ft. Wayne, to replace Mr. Geary. **W. A. Trimble**, supervisor on the Philadelphia division with headquarters at Downingtown, Pa., has been promoted to assistant division engineer on the Middle division, with headquarters at Altoona, Pa., succeeding **J. P. Newell**, who was transferred to the office of vice-president, operation, at Philadelphia.

Mr. Geary was born at Wilkinsburg, Pa., on March 29, 1891, and received his higher education at the University of Pittsburgh, from which he was graduated in 1913. Immediately upon graduation he entered the service of the Pennsylvania as



P. X. Geary

a rodman on the Pittsburgh division, at Pittsburgh, Pa. In 1917, he was promoted to assistant supervisor of track at Tyrone, Pa., and subsequently held this position at points on the Buffalo, Cleveland and Pittsburgh divisions, until 1927, when he was promoted to supervisor on the Allegheny division at DuBois, Pa. In that same year he was made master carpenter on the Renovo division, at Erie, Pa., and in 1928 came back to the track department as supervisor on the New York division, with headquarters at New York. In 1933, he was promoted to assistant division engineer of the Ft. Wayne division, with headquarters at Ft. Wayne, Ind., the position he was holding at the time of his recent promotion to division engineer of the Delmarva division with headquarters at Cape Charles, Va.

N. B. Reardon, assistant engineer of buildings of the Canadian Pacific, has been appointed engineer of buildings, with headquarters at Montreal, succeeding **J. W. Orrock**, who has retired under the pension regulations, effective June 30. Mr. Reardon has been succeeded as assistant engineer of buildings by **Laurence H. Laffoley**, who during recent years has been an assistant engineer in the building department.

Mr. Reardon was graduated from Cornell University in 1905 with the degree

August, 1937

559

of civil engineer. After his graduation he took part in the construction of the Rockefeller Hall of Physics and the Goldwin Smith Hall at Cornell University and was employed in the construction of schools and private residences in the United States. Mr. Reardon entered the service of the Canadian Pacific in 1912



N. B. Reardon

as a civil engineer in the building construction department at Montreal and has been active in every important building and hotel project undertaken by this company since that date. He became assistant to the superintendent of building construction in 1914, and in 1917 was appointed assistant engineer of buildings in the chief engineer's office, holding that position until his recent promotion to engineer of buildings.

Mr. Laffoley was born on March 14, 1894, at Montreal, Que., and received his higher education at McGill University, from which he was graduated in 1916. Mr. Laffoley first became connected with the Canadian Pacific during the vacation



Laurence H. Laffoley

periods of his college career. During the summer of 1912, he was employed as a timekeeper on the road, and during the summers of 1913 and 1914, he was employed as a draftsman. Immediately following graduation from college in 1916, Mr. Laffoley went overseas with the Canadian engineers, and there became a lieutenant, engaged with the operations of the Royal Air Force. Returning to Can-

Railway Engineering and Maintenance

ada, he re-entered the employ of the Canadian Pacific on June 1, 1919, as a draftsman on general engineering projects, and on June 1, 1923, was promoted to assistant engineer, under the engineer of buildings. He was holding this position at the time of his recent promotion to assistant engineer of buildings.

Mr. Orrock, who has had 46 years of service with the Canadian Pacific, was born on May 11, 1870, in Edinburgh, Scotland, and received his higher education at the Royal Scottish Academy. He entered the service of the Canadian Pacific as a draftsman on July 4, 1891, and subsequently held the position of assistant engineer until 1904, when he was promoted to chief draftsman. In 1912, he became division engineer at North Bay, Ont., and in 1913, was promoted to principal assistant engineer, which position he held until May, 1924, when he was promoted to engineer of buildings. During his regime, Mr. Orrock, in addition to having charge of general railway building construction, had direct charge of all of the extensive hotel



J. W. Orrock

construction work which has been carried out by his road, including such large projects as the Chateau Frontenac, at Quebec; the Banff Springs hotel, at Banff, Alberta; the Royal York hotel, at Toronto, Ont., and the Lake Louise hotel, in Alberta.

M. W. Beach has been appointed bridge engineer of the Northern Pacific with headquarters at St. Paul, Minn., to succeed **M. F. Clements**, whose death on June 8 was reported in the July issue. Mr. Beach has been in the employ of this company for 25 years. He was born on April 13, 1889, at Wolcott, N.Y., and was educated in civil engineering at the University of Michigan, graduating in 1911. He entered railway service with the Northern Pacific in November, 1912, as a draftsman and designer in the bridge department. In September, 1916, Mr. Beach was advanced to assistant engineer in charge of the valuation of bridges, remaining in the valuation department until June, 1922, except for one year which he spent on construction work. At the end of this period, Mr. Beach was appointed assistant engineer in the construction department and in November, 1928, he was promoted to assistant district

engineer with headquarters at St. Paul. In March, 1937, following several years on special assignments, Mr. Beach was appointed acting bridge engineer, which position he held until his appointment as bridge engineer effective June 15.

Chauncey S. Robinson, assistant engineer maintenance of way of the Maine Central and the Boston & Maine, has been



Chauncey S. Robinson

promoted to assistant chief engineer of these roads, with headquarters at Portland, Me., effective July 1. Mr. Robinson entered the service of the Maine Central as a rodman on July 1, 1909. In October, 1912, he was appointed assistant engineer and in 1919 he was promoted to the position of general supervisor maintenance of way. Five years later Mr. Robinson's title was changed to engineer maintenance of way, and early in 1936 he was appointed assistant engineer maintenance of way of the Maine Central and the Boston & Maine.

A. R. Ketterson, assistant engineer of bridges of the Canadian Pacific, has been promoted to engineer of bridges, with



A. R. Ketterson

headquarters as before at Montreal, Que., to succeed **Phillip B. Motley**, who retired under the company's pension regulations on June 30.

Mr. Ketterson received his general and technical education in Scotland. Shortly after graduating in civil engineering at Glasgow, he entered the service of the Canadian Pacific as an inspector on the con-

struction of bridges at Montreal. He was later assistant engineer at Montreal, and for a time served in the same capacity on the Western lines at Winnipeg, Man. After service in the World War, Mr. Ketterson returned to the C.P.R. as assistant engineer at Montreal, being appointed assistant engineer of bridges in May, 1928, the position he held until his recent promotion to engineer of bridges.

Mr. Motley was born in Calcutta, India, and completed his general and engineering education in England. He joined the Canadian Pacific engineering department at Montreal on August 13, 1892,



Phillip B. Motley

serving as a draftsman and as an inspector of bridges in both shop and erection work until 1903, when he became assistant engineer in that department. In 1908 he was appointed assistant engineer of bridges and on June 1, 1911, he became engineer of bridges, exercising supervision over the design and construction of bridges on the entire system.

Track

J. H. Gibbs, a section foreman on the Missouri Pacific at Wichita, Kans., has been promoted to roadmaster, with the same headquarters, to succeed **W. Ray**, who has retired.

E. V. Harrison, a section foreman on the Chicago & Eastern Illinois, has been promoted to supervisor of track with headquarters at Danville, Ill., to succeed **C. E. Oliver**, who has retired. **C. B. Wilkes**, also a section foreman, has been appointed supervisor of track at Villa Grove, Ill., to succeed **M. Henry**, retired.

William Niemen, a section foreman on the Chicago & North Western, has been promoted to roadmaster, with headquarters at Huron, S. D., to succeed **E. L. Hoffman**, who has been transferred with the same headquarters to a main line district, succeeding **E. M. McDermott**, who has been transferred to Mankato, Minn., replacing **R. Kearney**, who has retired.

O. H. Rhoads has been appointed assistant supervisor of track on the Reading, with headquarters at Lansdale, Pa., to succeed **H. L. Locke**, who has been trans-

ferred to West Trenton, N.J. Mr. Locke succeeds **J. W. DeMoyer**, who has been promoted to supervisor of track on Subdivision B, with headquarters at Philadelphia, Pa., to take the place of **R. W. Morrison**, transferred.

Charles W. Wilson has been appointed track supervisor on the Louisville & Nashville, with headquarters at Paris, Tenn., to succeed **William Raney**, deceased. Mr. Wilson was born at Paris on May 6, 1901, and entered the service of the Louisville & Nashville as a rodman after completing his public school education. He has had five years of continuous service with the L. & N. as a rodman and ten years as an instrumentman.

J. F. Young, assistant on the engineering corps of the Pennsylvania, Western region, has been promoted to assistant supervisor on the Philadelphia division, with headquarters at Chambersburg, Pa. **R. W. Speidel**, supervisor on the Monongahela division, at Homestead, Pa., has been transferred to the Philadelphia division, with headquarters at Downingtown, Pa., succeeding **W. A. Trimble**, whose promotion to assistant division engineer is noted elsewhere in these columns.

F. I. Hahs has been appointed roadmaster on the Atchison, Topeka & Santa Fe, with headquarters at Rincon, N. M., to succeed **M. R. Palmer**, who has been transferred to Las Vegas, N. M., to replace **J. E. Truitt**, who has been assigned to other duties. **Ed. Conway** has been appointed roadmaster at Oceanside, Cal., to succeed **A. L. Pollock**, who has been transferred to Los Angeles, Cal., to succeed **F. McNutt**, who has retired. **C. L. Conley** has been appointed acting roadmaster, with headquarters at Pueblo, Colo., to succeed **L. V. Lienhard**, whose appointment as acting division engineer is noted elsewhere in these columns.

Max C. Michaelis, who has been appointed roadmaster on the Gulf, Colorado & Santa Fe, with headquarters at Silsbee, Tex., as announced in the June issue, was born on September 7, 1885, at Cat Spring, Tex. He entered railway service on February 14, 1905, as a section laborer on the Missouri-Kansas-Texas, later being advanced to section foreman and fence gang foreman. On October 9, 1909, he left the Katy to join the Gulf, Colorado & Santa Fe as a section foreman, being appointed clerk to the general foreman and roadmaster at Sealy, Tex., on September 13, 1923. On December 28, 1928, Mr. Michaelis was appointed acting roadmaster at Alvin, Tex., where he later served as roadmaster and assistant roadmaster until his recent appointment as roadmaster at Silsbee.

Joe H. Boland, who has been appointed roadmaster on the Chicago, Milwaukee, St. Paul & Pacific, with headquarters at Janesville, Wis., as reported in the July issue, has been connected with this company for 12 years. He was born on August 22, 1906, and after a public school education he entered railway service with the Milwaukee in June, 1925, as an extra gang timekeeper. He served in this capacity and as a section laborer and assistant foreman until April, 1928, when he

was promoted to section foreman on the Illinois division. In July, 1929, Mr. Boland was further advanced to extra gang foreman, serving in this capacity and as section foreman until August, 1935, when he was appointed foreman in charge of the maintenance of 25 miles of newly-constructed line, with headquarters at Liberty, Mo. His promotion to roadmaster with headquarters at Janesville became effective on June 1.

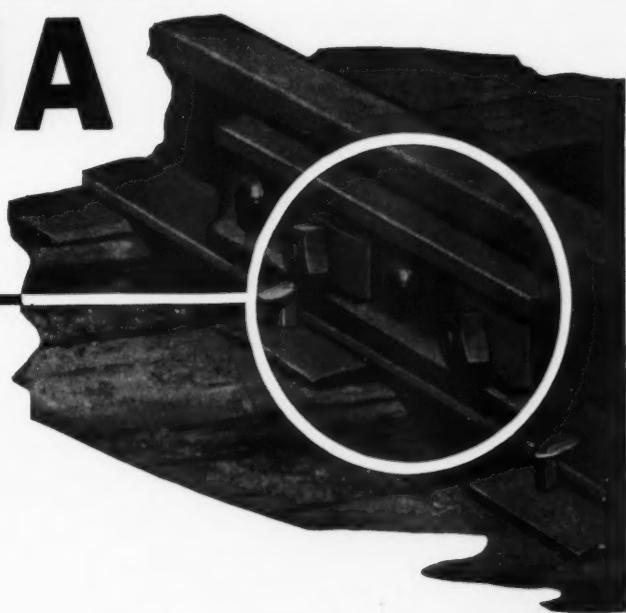
John C. Jacobs, who has been appointed supervisor of trains and track on the Illinois Central, with headquarters at Decatur, Ill., was born on August 3, 1892, at Amboy, Ill. After studying for a year at the University of Illinois, Mr. Jacobs entered railway service with the Illinois Central in February, 1912, serving as a chainman, rodman and instrumentman on construction and maintenance until February 1, 1917. On that date he left railway service to enter the employ of a contractor, later serving with the Miami Conservancy District at Dayton, Ohio, and with the Chicago, Burlington & Quincy as an assistant engineer in the valuation department. He returned to the Illinois Central in November, 1918, as an instrumentman, being appointed an assistant engineer in the construction department in February, 1923. From June, 1926, to September, 1931, he served as an assistant engineer on the St. Louis division, then being appointed an instrumentman on the same division. From April to October, 1936, he served as acting road supervisor on the Springfield division, then returning to the position of instrumentman. On June 10, 1937, Mr. Jacobs was appointed road supervisor on the Springfield division, holding this position until July 1, when he was appointed supervisor of trains and track.

Mathew L. Frederick, acting roadmaster on the Tacoma division of the Northern Pacific, with headquarters at Centralia, Wash., has been appointed roadmaster at the same point. Mr. Frederick was born on February 5, 1889, at Minneapolis, Minn., and obtained a public school, business college and correspondence school education. He entered railway service with the Northern Pacific on January 8, 1909, as a machinist apprentice at St. Paul, Minn. On June 17 of the same year he was appointed an extra gang timekeeper and after a year in this capacity he was promoted to extra gang foreman on the Idaho division. During the following eleven years Mr. Frederick served alternately as a section foreman and extra gang foreman on various divisions. On July 21, 1921, he was promoted to assistant roadmaster on the Tacoma division and from May 22, 1922, to November 20, 1924, he served as a section foreman and extra gang foreman on the same division. At the end of this period he was made a track inspector in the engineering department on the Tacoma division, and after somewhat more than a month in this capacity he returned to the position of section foreman. On February 1, 1926, Mr. Frederick was appointed assistant roadmaster on the Seattle division, and after two months in this position he was sent to the Tacoma division, where he served as a foreman and assistant road-

VERONA

Fixed Tension

TRIFLEX SPRING



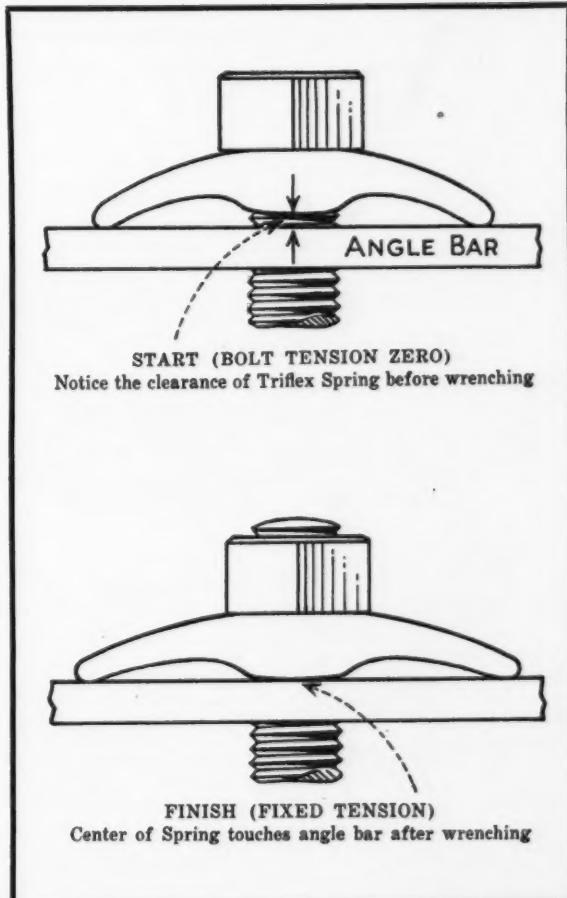
*The only accurate
practical means
of establishing*

EQUAL BOLT TENSION

in track joints +

HIGHEST REACTION

*in any spring washer
for track bolts.*



SINCE 1873

WOODINGS-VERONA
TOOL WORKS VERONA, PA.



SINCE 1873

master. On February 1, 1934, Mr. Frederick was promoted to track supervisor on the Tacoma division, which position he held until April 27, 1937, when he was appointed acting roadmaster, the position he was holding at the time of his recent appointment as roadmaster, with headquarters at Centralia.

Bridge and Building

E. R. Nelson, a bridge and building foreman on the Chicago & North Western, has been promoted to supervisor of bridges and buildings, with headquarters at Huron, S. D., to succeed **P. Paulson**, who has retired from active service.

Obituary

C. E. Double, roadmaster on the Chicago, Burlington & Quincy, at Lincoln, Neb., died on July 20.

Wayne Norman, roadmaster on the Chicago, Burlington & Quincy, with headquarters at South Sioux City, Nebr., was accidentally killed on July 20.

Frank Ivers, general roadmaster of the Northwestern district of the Union Pacific, with headquarters at Spokane, Wash., died on July 10 of a heart attack while en route by train to Colorado on a vacation trip.

William L. Seddon, who retired in 1936 as chief consulting engineer for the receivers of the Seaboard Air Line and as vice-president and consulting engineer for the corporation, died on July 12 at his home in Fredericksburg, Va. Mr. Seddon was born on October 14, 1862, in Stafford



William L. Seddon

County, Va., and received his higher education at the University of Missouri. He entered railway service in March, 1899, with the Seaboard Air Line, serving consecutively until September, 1905, as instrumentman, resident engineer and assistant engineer. From September, 1905, until January, 1913, he was chief engineer of the road and from the latter date until 1916, he was assistant to the president. Mr. Seddon was appointed vice-president in charge of operation in January, 1916, and in the following year he became general manager. He was appointed vice-

president and consulting engineer of the railway corporation on March 1, 1920, and when receivers were appointed on December 23, 1930, he became, in addition, chief consulting engineer for the receivers.

Edward E. Stetson, assistant engineer on the Pennsylvania, with headquarters at Chicago, died at his home at that point on July 13. Mr. Stetson was born in Mattapoisett, Mass., on October 8, 1882, and entered the service of the Pennsylvania on June 15, 1905. From November, 1917, to December, 1926, during the construction of the Chicago Union Station, Mr. Stetson served as assistant engineer on that project. Following its completion he returned to the Pennsylvania as assistant to the chief engineer, later being appointed assistant engineer, which position he held until his death.

Herbert S. Wilgus, who served in the engineering and maintenance of way departments of a number of railroads, died on July 7 at Delaware City, Del., at the age of 63 years. Mr. Wilgus was educated at Cornell University, graduating in 1901. Shortly thereafter he entered railway service with the Cleveland, Cincinnati, Chicago & St. Louis as an assistant engineer at Springfield, Ohio. Later, he went with the Pennsylvania as an assistant engineer and subsequently served as engineer in charge of maintenance of way of the Brooklyn Rapid Transit Company. Later, he became chief engineer of the Pittsburgh & Shawmut and from 1918 to 1924 he was manager of the Buckdale Coal Company, Dubois, Pa. Subsequently he entered the service of the New York Public Service Commission as assistant engineer of grade crossings, later becoming grade separation engineer, which position he was holding at the time of his death.

water filtration plants. Later he was employed by the Crescent Portland Cement Company during the construction of its plant and by the Pennsylvania Engineering Works as resident engineer on the construction of a Bessemer plant and trackage at Bethlehem, Pa. From 1911 to 1914 he was engaged in contracting work



Lewis Thomas

at Minneapolis and from 1914 to 1918 he served as senior civil engineer for the Interstate Commerce Commission. Then he became a sales representative of the Dravo-Doyle Company, Pittsburgh, Pa., and in 1920 resigned to become sales representative of the Q & C Company at Chicago. In 1928 he was promoted to district sales manager which position he has held until his recent promotion.

Arnold H. Told, general manager of the Positive Rail Anchor Company, Chicago, died in that city on June 25 of heart failure. He was born at Vevay, Ind., on November 11, 1883, and was educated at Denison University, Granville, Ohio. In 1906 he was employed as an assistant on an engineering corps for the Consolidated Mining Company at Spadra, Ark., and in the following year was a rodman for the St. Louis-San Francisco at Chaffee, Mo. In the same year he worked as a concrete inspector for the Baltimore & Ohio at Indiana Harbor, Ind., and in 1908 was an instrumentman in the United States Reclamation Service at Browning, Mont. In 1909 he became an engineer for the Columbia Gas and Electric Company at Huntington, W. Va., and in the following year entered the employ of the Chicago & North Western as instrumentman at Winner, S. D. In the following year he resigned to become instrumentman on the Canadian Pacific at North Transcona, Man., and in 1913 was promoted to resident engineer at this point. In 1914, he was promoted to assistant roadmaster at Souris, Man., and in the same year resigned to become an inspector for the Positive Rail Anchor Company at Winnipeg, Man. Later he was transferred to Montreal, Que., and in 1917 was made an engineer and salesman at New York. In 1919 he was promoted to general manager at Marion, Ind., and in 1927 was transferred to Chicago. Mr. Told took an active part in the Track Supply Association, of which organization he was president in 1926-27.

Supply Trade News

Personal

Frank T. Sheets, consulting engineer and director of development for the **Portland Cement Association**, Chicago, has been elected president to succeed **Edward J. Mehren**, retired.

H. M. Arrick, who for the last 10 years has been associated with the **American Rolling Mill Company**, Middletown, Ohio, in various railroad sales capacities, has been appointed manager of the newly-created district office of the **Armco Railroad Sales Company**, with headquarters in the Ambassador building, St. Louis, Mo.

Lewis Thomas, district sales manager of the **Q & C Company**, at Chicago, has been promoted to general sales manager with the same headquarters. Prior to graduating from Lehigh University, Mr. Thomas was employed in maintenance and construction work on the Pennsylvania at Newcastle, Pa. Subsequently he entered the employ of Alexander Potter, consulting engineer at New York, in which capacity he assisted in the construction of

A Good Job of Rail Laying Results in



Better Track and Lower Maintenance

RAIL laying of today becomes your maintenance problem of tomorrow. Long experience has demonstrated that Ingersoll-Rand pneumatic tools do much more than speed up the actual laying of rail—they produce by far a more permanent track structure which is less expensive to maintain.

Pneumatic spike driving and pulling can be maintained at a rapid clip all through the day. The even and rapid blows of the spike driver produce better holding power of spikes enabling them to draw up ties better to the rail. For bolting rail, power-wrenching is far superior to hand-wrenching from the standpoint of uniformity, speed, and the lasting quality of the work.

And for resurfacing track—I-R pneumatic tampers pack the ballast firmly and uniformly under each tie—around and under frogs, switches, crossings, etc.—in fact all places virtually impossible to reach with picks or bars. We will be glad to send you booklet showing performance data on I-R labor-aiding tools.

531-11

Ingersoll-Rand

11 BROADWAY, NEW YORK CITY

Atlanta
Birmingham
Boston
Buffalo
Butte
Chicago
Cleveland
Dallas
Detroit
Denver
Duluth
El Paso
Hartford
Houston
Knoxville

Los Angeles
Newark
New York
Philadelphia
Picher
Pittsburgh
Pottsville
San Francisco
Salt Lake City
Scranton
Seattle
St. Louis
Tulsa
Washington



**The Pre-Convention Edition of the October
or ROADMASTERS' CONVENTION ISSUE of
Railway Engineering and Maintenance**

**It's the Source from Which the Reports Are
Read at the ROADMASTERS' CONVENTION**

As for the last twenty years, Railway Engineering and Maintenance will publish the reports of all of the committees of the Roadmasters' Association in an advance edition, copies of which will be distributed to every person attending the convention. These reports will be available only in this edition. It will be constantly in the hands of those at the meeting.

To manufacturers of track materials and equipment, this offers a double service.

(a)—Special convention distribution, with YOUR story constantly in the hands of those attending this important meeting.

(b)—Complete distribution, with the convention story in full, to all subscribers after the meeting adjourns.

At this time when maintenance officers are in the midst of their most active season in six years, they are keenly interested in materials—equipment. Furthermore, they are now beginning to think—and plan—for 1938, with its still larger programs in prospect. This issue, with its double service, offers an opportunity to tell your story to these men when they are most receptive—and to sow the seed for next year's sales in the most efficient season for planting.

Forms close September 7

**RAILWAY ENGINEERING AND MAINTENANCE IS
READ BY MAINTENANCE OFFICERS OF ALL RANKS**

WHEN IS A CUSTOMER SATISFIED?



GENERAL OFFICES
BAY CITY, MICHIGAN

INDUSTRIAL BROWNHOIST

NEW YORK, PHILADELPHIA
CLEVELAND, CHICAGO

Satisfied customers are the foundation of any business. Meeting a specification or a delivery date helps, but these are only a start.

Here at Industrial Brownhoist, we believe that a customer should be satisfied only after years of dependable and profitable operation from the crane we sell him. This involves many things—design, construction and even our selling methods—for it means that our locomotive or crawler crane must prove itself the most economical unit for your handling work.

This slow, but sure, method of building customer good-will is responsible, in our case, for the world's most complete line of locomotive cranes. It is responsible, too, for the unusually high regard in which the name Industrial Brownhoist is held wherever materials are handled.

Are you satisfied with your present material handling costs? If not, we would like you to be one of our kind of customers.

FREIGHT HOUSE
EW
10
T HOUSE

BETTER ROOF PROTECTION and LONGER SERVICE with Mule-Hide 5" Safety Lap Roll Roofing

TESTED AND PROVEN
IN OVER 30 YEARS
USE BY MANY OF THE
LEADING RAILROADS

All nail heads are covered—no exposed nails.
Makes a solid one piece roof, firmly welded
together.

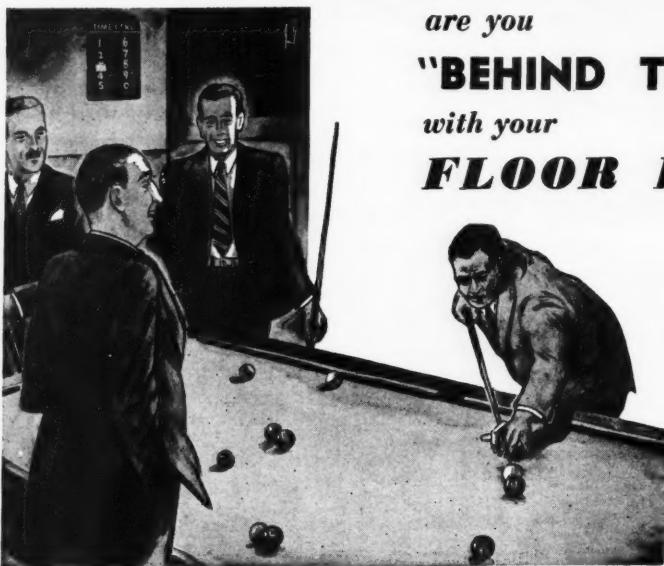
Eliminates expensive maintenance costs.
No need for re-nailing loose seams, patching
or repairs caused by exposed nails that have
rusted, broken off, or pulled out.

WRITE FOR
INFORMATION
AND DETAILS

ASPHALT
THE LEHON COMPANY
44th to 45th St. on So. Oakley Ave. Chicago, Illinois



ASBESTOS



are you
"BEHIND THE 8-BALL"
with your
FLOOR PROBLEMS?

To withstand the rumble of trains and heavy traffic around active stations and warehouses, railroad buildings demand floors that are

RESILIENT
 DURABLE
 PERMANENT
 QUICKLY INSTALLED

Leading railroad companies all over the world keep their floors fit with

STONHARD RESURFACER

No chopping up old floors—No expensive preparation—No special tools. A trial demonstration at any point on your line will prove the advantages of using this safe and serviceable, non-skid material for patching ruts or for complete overlays.

STONHARD COMPANY

1323 CALLOWHILL STREET

PHILADELPHIA, PENNSYLVANIA

WRITE TO RAILROAD AND PUBLIC UTILITIES DEPARTMENT FOR FREE MAINTENANCE BOOK

NOW AVAILABLE

3rd Edition

STRING LINING OF CURVES MADE EASY

By CHARLES H. BARTLETT

To meet the continuing demands for this booklet, reprinting a series of articles published originally in Railway Engineering and Maintenance, a third edition has just been printed and is now available.

Written to meet today's exacting standards for curve maintenance, this booklet presents in detail a method of proven practicability for checking and correcting curve

alignment readily with tools that are at hand. It makes possible the accurate realinement of curves without engineering instruments or other appliances than a string and a rule.

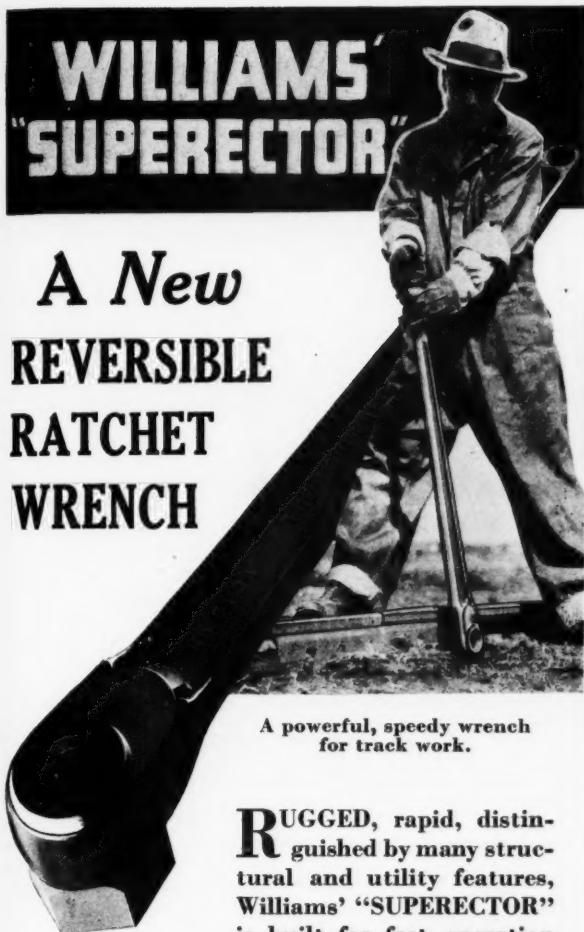
Two editions of this booklet, each of 1,000 copies, have already been purchased by track men. Send for your copy of this practical aid for track maintenance.

Fifty Cents a Copy

Railway Engineering and Maintenance

105 W. ADAMS STREET

CHICAGO, ILL.



A powerful, speedy wrench
for track work.

RUGGED, rapid, distinguished by many structural and utility features, Williams' "SUPERECTOR" is built for fast operation and severe service. Quad-

tuple Pawls provide double bearing, strength and durability. **Dropforged** handle utilizes the extra strength afforded by the pawls.

Five sizes 24 to 53". Both Hex and Square Sockets, with hole extending clear through operate nuts on any length of bolt; openings 1 to 4-5/8 inches.

The "SUPERECTOR" embodies many other refinements that make it outstanding. Ask your distributor, or write for descriptive literature today!

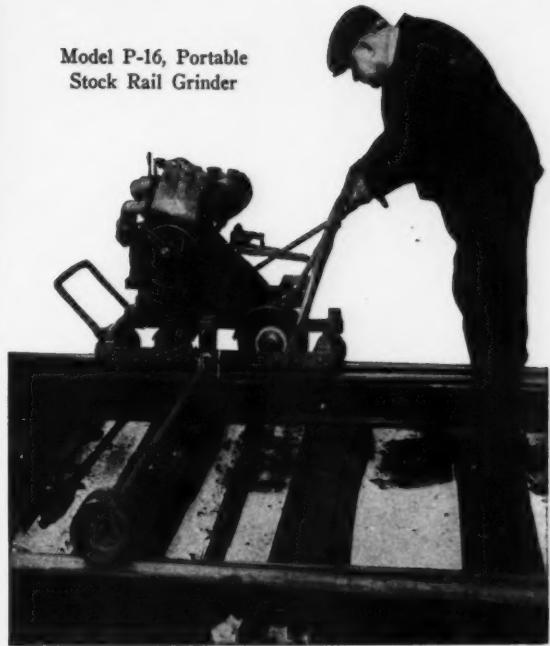
All Fully Guaranteed

J. H. WILLIAMS & CO.
75 Spring St., New York

Headquarters for: Drop-Forged Wrenches (Carbon and Alloy), Detachable Socket Wrenches, "C" Clamps, Lathe Dogs, Tool Holders, Eye Bolts, Hoist Hooks, Thumb Nuts and Screws, Chain Pipe Tongs and Vises, etc., etc.



Model P-16, Portable
Stock Rail Grinder



An Economy that Passengers Appreciate—

Rejuvenating worn rail costs so much less than renewing it, that the economy runs into big figures. Passengers appreciate the smooth, swift, safe and silent travel that you can offer only on rail devoid of battered ends and free from corrugations. Welding and grinding are economies that attract traffic. For grinding with economy and precision, select the Railway Track Grinders that meet your needs. The choice is wide. Many models. Write for newest data bulletins.

Railway Trackwork Co.

3132-48 East Thompson St., Philadelphia

**WORLD'S HEADQUARTERS
FOR TRACK GRINDERS**

FOR SAFE

TRACK TOOLS

Depend on hand tools made of controlled alloy steel . . . steel that adds safety to every tool . . . tools that protect your workmen from flying chips that often cause accidents.

The Devil line of track tools is made of special electric furnace alloy steel that is not only first for safety, but also capable of a long life with hard usage. Send for the Warren Tool Catalog that shows sizes and weights of the complete line of Devil tools . . . tools built to do hard jobs with "safety."

WARREN TOOL CORPORATION
WARREN • OHIO

SPEED UP MAINTENANCE with
Mall RAIL GRINDERS
 There Is A Type For Every Rail Maintenance Job!



Screw spike driving with a MALL 3 H.P. gas engine unit.

MALL rail grinders are being used profitably by America's leading railroads for rail surface grinding, switch point, stock rail, frog, crossing and cross grinding; also, for rail drilling, wood boring, and screw spike driving. One unit can be used for all of these jobs by simply attaching the necessary tool at the end of the heavy duty flexible shafting for each job.

Write for descriptive literature!

MALL TOOL COMPANY

Railroad Department
 7746 South Chicago Ave. Chicago, Illinois
 OFFICES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Recommended Books on
RAILWAY ENGINEERING
AND
MAINTENANCE

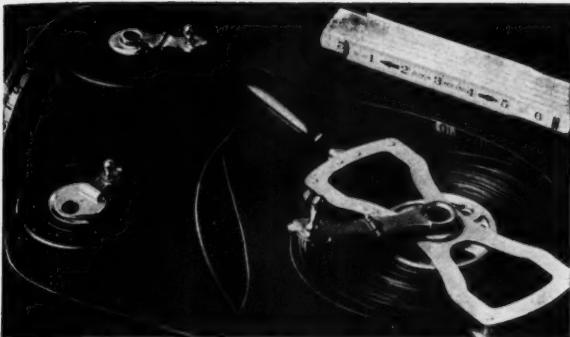
The list is divided into four sections:

- I. Engineering and Track—5 pages
- II. Bridge Engineering—2 pages
- III. Building Department—10 pages
- IV. Water Service—1 page

The pages are $8\frac{1}{2} \times 11$ inches, mimeographed. Free on Request—Specify sections.

Book Service Department
Simmons-Boardman Publishing Corp.

38 Church Street, New York



There's more MILEAGE in LUFKIN TAPES and RULES

Longer, steadier and more satisfactory service is "built into" them. They're not only Accurate and Well Designed, but there're sturdy.

That's why they deliver greater mileage on all jobs. That's why they're the "stand-by" on Railroad Engineering and Maintenance work.

Specify "Lufkin" and get your share of this extra mileage. Send for Catalog No. 12.



TAPES • RULES • PRECISION TOOLS
SAGINAW, MICHIGAN • New York City

MANGANAL

Reg. U. S. Pat. Office

11-13½% Nickel Manganese Steel

(U. S. Patents 1,876,738, 1,947,167 and 2,021,945)

WELDING ELECTRODES

RECLAIM

11 TO 14% MANGANESE STEEL
FROGS and CROSSINGS

AS GOOD AS NEW
AND
AT LESS COST

75 Distributors Are Anxious To Serve You.

SOLE PRODUCERS

STULZ-SICKLES CO.

134-142 Lafayette St., Newark, N. J.

Simplex Track Jacks

are ELECTRIDED to
reduce wear *an exclusive
Simplex feature*

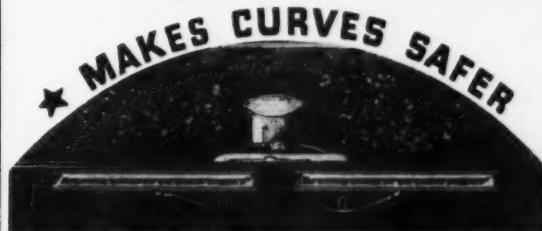
Simplex Rail Puller & Expanders
For Lining Crossings and Re-newing
Fibre End Posts

The G-Y Tie Spacers *protect Ties*

Our Purpose is to build
every Simplex product so
thoroughly that each will
create the market for another

Templeton, Kenly & Co.

EST. 1899
New York • Chicago • California • Pa. Atlanta
Dallas • San Francisco



MECO RAIL AND FLANGE LUBRICATOR

MECO Lubrication decreases derailment hazards.

Read what Railway
Officials say: ★ ★ ★

"Although we have no definite records, one striking feature of our use of greasing machines has been the almost complete elimination of derailments on the high rail, due to sharp flanges."

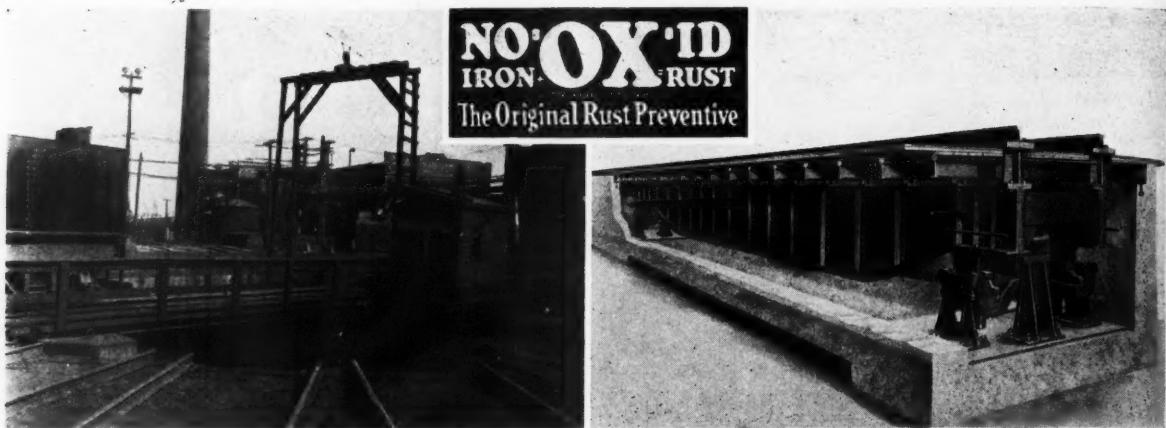
★ ★ ★ ★

"The fact that the high rail is lubricated by Mecos is responsible for no derailments on the curves since Lubricators were installed." Most safety features add expense. Mecos reduce expense while adding safety.

Look for the advertisements to follow in this series.

MAINTENANCE EQUIPMENT CO.
Railway Exchange Bldg., Chicago, Ill.

No. 3 of a series giving evi-
dence supporting the statements
enumerated in the March issue.



Protection for Turn Tables and Track Scales

NO-OX-ID is used on turn tables and track scales to prevent loss of metal and replacements and to lubricate bearings. It is economical, long lasting and gives positive chemical and mechanical protection.

Use NO-OX-ID also on steel bridges, tanks, buildings,

and pipe buried or exposed.

If you are not using NO-OX-ID, send for our interesting data and recommendations on "Maintenance of Steel Structures in the Railroad Industry." NO-OX-ID greatly reduces maintenance costs.

DEARBORN CHEMICAL COMPANY

310 S. Michigan Ave.,
CHICAGO

205 East 42nd St.,
NEW YORK

Canadian Factory and Offices:
2454-2464 Dundas St., W., Toronto

ALPHABETICAL INDEX TO ADVERTISERS

Air Reduction Sales Company.....	521
American Hammered Piston Ring Division of Koppers Co.....	512-513
American Steel & Wire Company.....	519
Armco Culvert Mfrs. Assn.....	571
Barco Manufacturing Company.....	522
Bartlett Hayward Division of Koppers Co.....	512-513
Bethlehem Steel Company.....	525
Columbia Steel Company.....	519
Dearborn Chemical Company.....	570
Eaton Manufacturing Co.....	510
Hayes Track Appliance Co.....	514
Illinois Malleable Iron Company.....	572
Industrial Brownhoist Corp.....	565
Ingersoll-Rand.....	563
Ingot Iron Railway Products Co.....	571
Koppers Coal Co., The.....	512-513
Lehon Company, The.....	565
Lufkin Rule Co., The.....	569
Lundie Engineering Corporation, The.....	515
Maintenance Equipment Co.....	569
Mall Tool Company.....	568
Maryland Dry Dock Co.....	512-513
Metal & Thermit Corporation.....	516
National Lock Washer Company, The.....	509
National Lumber and Creosoting Co.....	512-513
Nordberg Mfg. Co.....	517
Oxweld Railroad Service Company, The.....	528
Rail Joint Company, Inc.....	520
Railroad Accessories Corporation.....	511
Railway Track-work Co.....	567
Ramapo Ajax Corporation.....	523
Simmons-Boardman Pub. Corp.....	564-566-568
Stonhard Company.....	566
Stulz-Sickles Co.....	569
Tar & Chemical Division of Koppers Co.....	512-513
Templeton, Kenly & Co.....	569
Teleweld, Incorporated.....	518
Tennessee Coal, Iron & Railroad Co.....	519
Truscon Steel Company.....	526
Union Carbide and Carbon Corp.....	528
United States Steel Corporation Subsidiaries.....	519
United States Steel Products Company.....	519
Warren Tool Corporation.....	568
White Tar Company of New Jersey, Inc., The.....	512-513
Williams & Co., J. H.....	567
Wood Preserving Corporation, The.....	512-513
Woodings Forge and Tool Co.....	561
Woodings-Verona Tool Works.....	561

STOP THIEF!



A systematic program of subdrainage with Armco Perforated Pipe will reduce your operating costs — speed up your schedules — and increase your ability to gain and hold new business.

SOUND JUDGMENT will not allow progressive railways to go on paying *thousands of dollars every year* for slow orders and excessive track maintenance. Today these costly conditions can and are being permanently eliminated by scientific subdrainage methods.

In hundreds of cases where Armco perforated pipe has been installed, slow orders have been removed, safety and passenger comfort improved, and maintenance costs greatly reduced. Call in an experienced Armco drainage engineer and let him show you the actual

savings accomplished by typical installations. Ask him to work with your own staff in achieving similar results for you.

This highly specialized service is offered to you without obligation. Simply address our nearest office. Ingot Iron Railway Products Company (Member of the Armco Culvert Mfrs. Assn.), Curtis Street, Middletown, Ohio; Berkeley, California; Philadelphia, Dallas, Atlanta, Salt Lake City, Minneapolis, Los Angeles, St. Louis, Portland, Cleveland, Spokane, Chicago, Richmond, Houston and Denver.

ARMCO

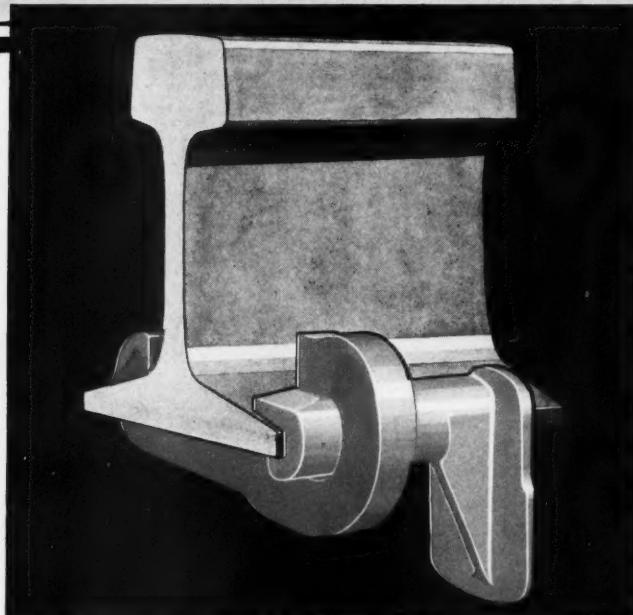


PERFORATED PIPE

The Logical Choice

ERICSON RAIL ANCHOR

THE
RAIL ANCHOR
WITH A
TAKE-UP



Track, in these modern days of high speed streamliners as well as the heavy freight trains, requires more rail anchors than ever before.

By checking rail creepage occasioned by the various weights and speeds, rail anchors play an important part in the maintenance of track.

Due to its many outstanding advantages the ERICSON RAIL ANCHOR (the anchor with a take-up) is the most logical choice.

This is attested by the fact that over 20 million are now in use by over 70 railroads.

Manufactured and Sold by

ILLINOIS MALLEABLE IRON COMPANY

(RAILROAD DIVISION)

310 South Michigan Avenue

CHICAGO, ILLINOIS

NY
HOIS